Chronic Diseases and Injuries in Canada

Volume 33 · Number 1 · December 2012

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Chronic Diseases and Injuries in Canada
a publication of the Public Health Agency of Canada

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Indexed in Index Medicus/MEDLINE, SciSearch® and Journal Citation Reports/ Science Edition

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.
— Public Health Agency of Canada

Published by authority of the Minister of Health.
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ISSN 1925-6515

This publication is also available online at **www.publichealth.gc.ca/cdic**
Également disponible en français sous le titre : *Maladies chroniques et blessures au Canada*

Child care: implications for overweight / obesity in Canadian children?

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This article has been peer reviewed.

Abstract

Introduction: Over recent decades, two prominent trends have been observed in Canada and elsewhere: increasing prevalence of childhood overweight and obesity, and increasing participation of women (including mothers) in the paid labour force and resulting demand for child care options. While an association between child care and children's body mass index (BMI) is plausible and would have policy relevance, its existence and nature in Canada is not known.

Methods: Using data from the National Longitudinal Survey of Children and Youth, we examined exposure to three types of care at age 2/3 years (care by non-relative, care by relative, care in a daycare centre) in relation to change in BMI percentile (continuous and categorical) between age 2/3 years and age 6/7 years, adjusting for health and socio-demographic correlates.

Results: Care by a non-relative was associated with an increase in BMI percentile between age 2/3 years and age 6/7 years for boys, and for girls from households of low income adequacy.

Conclusion: Considering the potential benefits of high-quality formal child care for an array of health and social outcomes and the potentially adverse effects of certain informal care options demonstrated in this study and others, our findings support calls for ongoing research on the implications of diverse child care experiences for an array of outcomes including those related to weight.

Keywords: body mass index, Canada, child care, obesity, overweight

Introduction

The prevalence of childhood overweight/obesity has increased in North America, Europe and elsewhere over recent decades.[1,2] In Canada, the prevalence of obesity has more than doubled from 3% in 1978 to 8% in 2004 among children aged 2 to 17 years,[3] which has led to increasing concern about short- and long-term health implications such as hypertension, type 2 diabetes and psychosocial problems.[4]

Over a similar period, a key societal trend in North America has been the increasing proportion of women in the paid labour force.[1,5,6] For example, the participation of women in the labour force in Alberta increased steadily from 20% in 1951 to 68% in 2008[6] and in Canada from 50% in 1976 to 80% in 2001.[7] Although historical statistics on the participation of mothers in the Canadian labour force is sparse, data on women's labour force participation by age[7] and marital status[6] suggest a similar growth in proportion of working mothers of young children. In 2005, 76% of mothers with a youngest child between 3 and 5 years old worked outside the home.[8] This may have implications for overweight/obesity in children:[8] studies from the United States,[9] Canada[10,11] and the United Kingdom[12] have shown a positive association between maternal work intensity (i.e. hours of work per week) and her child's likelihood of being overweight/obese.

One way through which maternal employment may impact children's weight status is child care arrangements. The rise in maternal employment has increased the demand for both formal (e.g. regulated care settings) and informal (e.g. care by relatives) child care arrangements, particularly for preschool-age children. Availability and use of formal versus informal care varies by country. Canada, relative to other countries in the Organisation for Economic Co-operation and Development, has a fairly high proportion of mothers of young children who work outside the home, low spending on child and family programs as a proportion of gross domestic product and high costs to parents for formal child care programs.[5,13] Thus, in contrast to some other countries (e.g. Sweden) that provide high quality, publically funded care,[5,6] Canada (along with other liberal-democratic regimes* such as

* Term used in classifications of welfare state regimes to describe those characterized by active and passive encouragement of market forces.[14] These regimes have also been described as Anglo-Saxon models of capitalism.[15]

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the U.S.) relies much more on the market for this service. This results in high use of informal care,[5] which can vary considerably in quality. Regulated care opportunities in Canada, with the possible exception of Quebec, are in short supply and are inaccessible to many because of their cost or inflexibility to the labour force needs of parents.[5]

Child care arrangements—formal or informal—may have implications for childhood obesity. The care setting may promote weight gain if, for example, care providers are less likely than parents to provide adequate nutrition and/or opportunities for physical activity. A handful of studies have examined child care arrangements in relation to obesity in children. Lumeng et al.[16] examined overweight status among a nationally representative sample of 6- to 12-year-old U.S. children in relation to child care attendance from age 3 to 5 years (retrospective reporting by parents); they observed a reduced risk of overweight among children who had experienced some (i.e. less than 15 hours per week) centre-based care attendance compared with those with no attendance. Maher et al.[17] examined obesity among a nationally representative sample of U.S. children entering kindergarten in relation to various types of care prior to kindergarten (retrospective reporting by parents); they observed that children in family/friend/neighbour care (paid or unpaid, at least 10 hours per week) were more likely to be obese than children in no or limited care. Benjamin et al.[18] examined adiposity in a sample of U.S. children in relation to child care from birth to 6 months and found that care in someone else's home (such as a licensed family child care home or family's, friend's or neighbour's home) was associated with increased adiposity at 1 and 3 years of age. For both Maher et al.[17] and Benjamin et al.,[18] centre-based care was not associated with weight outcomes. Kim and Petersen[19] found that child care by a relative, but not centre-based or non-relative care, was associated with significantly more weight gain in the first 9 months of life when compared to no child care. Pearce et al.[20] examined the association between child care (formal and informal) and overweight/obesity among children in the U.K. Millennium Cohort. They found that informal child care (especially care by grandparents) between 9 months and 3 years of age was associated with increased risk of overweight/obesity at age 3 years, but only for children from more advantaged backgrounds. There was no association between overweight/obesity and formal care (nursery, child care centre, nanny, or au pair). Among a representative German sample, Rapp et al.[21] found no association between type of preschool care and body mass index (BMI) at age 4 and 6 years. Finally, Gubbels et al.[22] observed that, among a sample of Dutch offspring of women participating in a prospective cohort study, the use of formal child care outside the home at 1 and 2 years of age was positively associated with BMI at age 2 years as well as change in BMI from age 1 to 2 years.

Based on these studies, certain informal types of care may present a risk for BMI and weight gain.[17–20] Findings for formal centre-based care are less clear: one study showed a protective effect,[16] one showed a risk effect,[22] and several others showed no effect.[17–21] One limitation of the existing studies, which may complicate the overall conclusions, is that boys and girls were combined rather than examined separately. The child-caregiver interaction may differ by sex (for example, due to gender norms held by the caregiver) such that previous null and inconsistent findings may reflect non-stratified analysis.

Our objective was to examine three types of child care arrangement at age 2/3 years in relation to subsequent change in BMI between age 2/3 years and age 6/7 years in a nationally representative sample of Canadian children. We stratified the analyses by sex to investigate whether the possible effects of different care arrangements on BMI differ for boys and girls.

Data and methods

Data source

We analyzed data from the National Longitudinal Survey of Children and Youth (NLSCY), a long-term study of Canadian children that follows their development from birth to early adulthood. The inaugural cohort, which was the only subsample for whom BMI data were available from age 2/3 years to age 6/7 years, included over 22 000 children aged 0 to 11 years at the time of enrollment in 1994. Since then, there has been some sample attrition so that by cycle 5 (2002–2003) approximately 67% of the original cycle 1 cohort remained. Like other Statistics Canada surveys, the NLSCY excludes children living on First Nations reserves or on Crown Land, residents of institutions, families of full-time members of the Canadian armed forces, and residents of some remote regions and the territories. A probability sampling strategy was used (with elements of both cluster and stratified random sampling based on geographic region and urban/rural status), and sampling weights were developed to enhance the sample's representativeness of its underlying original population. Data were collected using computer-assisted interviewing, in person or via telephone, with the respondent or his/her parent/guardian.

We focused on children from the original cohort who were aged 2 or 3 years in either of the first two survey cycles (cycle 1 [1994] or cycle 2 [1996]), for whom we also had BMI data at age 6 or 7 years. We selected age 2/3 years as the exposure period because 2 is the youngest age for which BMI and BMI-for-age percentile is recommended.[23] We selected age 6/7 years as the follow-up age because it represents a significant period of time over which to examine a possible enduring effect of child care, but it is not so long that it would be impossible to account for a myriad of intervening factors.

Variables

BMI was calculated for each child at age 2/3 years and age 6/7 years using height and weight data reported by the parent/guardian. A corresponding BMI-for-age percentile was assigned to each child, using the growth charts developed by Centers for Disease Control and Prevention.[24] Several Canadian professional organizations[25] have endorsed these growth charts, which are based on a

reference population of U.S. children, to track growth of individual children.[25,26] We examined BMI percentile as an outcome variable in two ways: first, as a continuous variable, indicating the difference in percentile between age 2/3 years and age 6/7 years; and second, as a categorical variable, as in whether the child falls into the normal (BMI $< 85^{th}$ percentile) or at-risk (BMI $\geq 85^{th}$ percentile) range at age 2/3 years and age 6/7 years.

Our main predictor variable was exposure to child care (at least 10 hours per week) at age 2/3 years, as reported by the primary caregiver. We examined three types of care: care by a non-relative, care by a relative and care in a daycare centre. We also included the following covariates (from age 2/3 years), based on the literature[27,28]: income adequacy (standard Statistics Canada classification based on household income and number of persons in the household†; three categories); highest household educational attainment (high school graduation or less, some post-secondary education, post-secondary graduation or higher); number of siblings (0, 1, $\geq$ 2); number of parents in the household (1 versus 2); birth weight (normal versus low/very low [< 2500 g]); mother's age at birth (13–19 years or 35–54 years [both higher risk] versus 20–34 years [lower risk]); province of residence; urban versus rural residence; and survey cycle (i.e. whether the child was age 2/3 in cycle 1 [1994] or cycle 2 [1996]).

Analysis

We used two analytic strategies, corresponding to the two (continuous and categorical) versions of the outcome variable. First, we used ordinary least squares (OLS) regression to regress BMI percentile change (continuous) on child care (care by non-relative, care by relative, daycare centre), unadjusted and adjusted for covariates, for boys and girls separately. Also using OLS, we tested two-way (child care type * income adequacy [low versus not low]) interaction terms to explore the possibility that the impact of child care on BMI percentile differs by socioeconomic circumstances, as shown elsewhere.[20] Second, using binary logistic regression, we examined a) the odds of moving into the at-risk BMI percentile range ($\geq 85^{th}$ percentile) by age 6/7 years in children who were in the normal BMI percentile range ($< 85^{th}$ percentile) at age 2/3 years, and b) the odds of moving into the normal BMI percentile range by age 6/7 years among children who were in the at-risk percentile range at age 2/3 years, in relation to child care type, unadjusted and adjusted for covariates, for boys and girls separately. The logistic models were used to explore whether response to child care may vary by initial BMI status, thus complementing the OLS regression model that assumes uniform response regardless of BMI.

We initially ran models using five types of care (care in someone else's home by a non-relative; care in own home by a non-relative; care in someone else's home by a relative; care in own home by a relative; and care in a daycare centre). Because respondents could report more than one type of care, the five care types were represented in the models using five non-mutually exclusive variables. To query whether it was appropriate to assume no interactions amongst care types, we conducted a likelihood ratio test comparing two OLS models: the first containing the five care types, and the second containing all possible combinations of care types (n = 28, excluding combinations with zero cases). For both boys and girls, we were unable to reject the null hypothesis of no difference between models, thus supporting use of the model with five care types entered as independent variables. However, none of the five care types showed an association with BMI percentile, and thus we explored the possibility of a more parsimonious model. Specifically, we tested the interaction between caregiver (relative; non-relative) and care venue (in own home; in other's home). Finding no interaction, we collapsed these four care types into two (care by non-relative, regardless of venue; and care by relative, regardless of venue). Care in a daycare centre constituted the third care type. Because respondents could report more than one type of care, the reference category for each care type is absence of that care type, regardless of other forms of care reported.

We used Stata version 11.0 (StataCorp LP) for all analyses. All models incorporate appropriate longitudinal sampling weights to account for the complex survey design and to approximate the original population (i.e. the population at the time of original cohort sample selection), and bootstrap weights to estimate standard errors and confidence intervals.

The study received ethics approval from the Conjoint Health Research Ethics Board at the University of Calgary, Ethics ID # E-22399.

Results

Descriptive statistics for the sample are shown in Table 1. Of the 5654 children potentially available for our study (i.e. age 2/3 years in cycle 1 or cycle 2 and still in the survey at age 6/7 years), 4955 had BMI data at age 2/3 years and 3916 had BMI data at both age 2/3 years and age 6/7 years. Thus, 1738 children (30.7% of the original sample) were excluded due to missing BMI data, mostly at age 6/7 years. Compared to those with complete BMI data at age 2/3 years and age 6/7 years, those with missing BMI data at age 6/7 years were more likely to have low household income adequacy (both boys and girls); have low household education (both boys and girls); live in a single-parent household (both boys and girls); have a young (i.e. < 20 years) mother at time of birth (both boys and girls); and live in Quebec (both boys and girls) (at $p < .05$). They were less likely to have siblings (girls only); live in Prince Edward Island (boys only); live in Ontario (girls only); and live in a rural environment (boys only). For girls, there were no

† For example, the lowest income adequacy category in the 1994 cohort was assigned to households for which household income was < $10,000 and household size was 1 to 4 persons, and those for which household income was < $15,000 and household size was 5 or more persons (NLSCY Data Dictionary, Cycle 1. Available at www.statcan.gc.ca). The original variable had 5 categories, which we collapsed to 3 so that each category had adequate size.

TABLE 1
Weighted descriptive statistics for study sample, stratified by sex

Variable	Girls (n = 1760)	Boys (n = 1804)
Mean (SD) BMI percentile change, age 2/3 to 6/7 years	.064 (.018)	.060 (.016)
BMI status		
At risk ($\geq 85^{th}$ percentile) at age 2/3 years, %	45.8	47.4
At risk ($\geq 85^{th}$ percentile), age 6/7, %	38.3	40.1
Care by non-relative (yes), %[a]	25.5	28.8
Care by relative (yes), %[a]	13.7	13.4
Care in daycare centre (yes), %[a]	11.9	9.0
No care (other than parents), %[b]	57.0	56.0
Household income adequacy, %[c]		
Lower	13.8	14.3
Middle	30.1	31.7
Higher	56.1	54.1
Household education, %		
High school graduation or less	19.9	17.1
Some post-secondary	24.8	25.7
Post-secondary graduation plus	55.3	57.2
Number of siblings, %		
0 (only child)	26.2	27.6
1	47.0	45.4
2+	26.7	27.0
Number of parents in household, %		
1 (single parent)	9.1	12.4
2	90.9	87.6
Birth weight, %		
Low / very low [< 2500g]	7.9	5.1
Normal	92.1	94.9
Mother's age at child's birth, %		
13–19 years or 35 years+ (high risk)	10.7	12.2
20–34 years	89.3	87.8
Province of residence, %		
Newfoundland	1.6	1.9
Nova Scotia and Prince Edward Island[d]	3.1	4.0
New Brunswick	2.7	2.7
Quebec	22.9	23.2
Ontario	42.7	41.6
Manitoba	4.0	3.8
Saskatchewan	3.6	3.8
Alberta	10.0	9.7
British Columbia	9.5	9.3
Urban / rural residence, %		
Urban	83.7	82.6
Rural	16.3	17.4
Survey cycle, %[e]		
Cycle 1	55.7	57.0
Cycle 2	44.3	43.0

Table continued, see right column

differences in reported child care between those with missing and non-missing BMI data. For boys, those with missing BMI data were less likely to report care in another's home by a non-relative or care in their own home by a relative than those with complete BMI data. Of the 3916 children with complete BMI data, 3889 had complete child care data and 3745 had complete data on all covariates. Our final sample size, after purposefully excluding an additional 181 who reported less than 10 hours of child care per week, was 3564 (1760 girls and 1804 boys).

Results of OLS regression (BMI percentile change regressed on the three care types) are presented in Table 2a (for girls) and 2b (for boys). There were no associations between child care and BMI percentile change for girls (Table 2a), while for boys (Table 2b), care by a non-relative was associated with an increase in BMI percentile between age 2/3 years and 6/7 years, relative to no non-relative care.

According to results of our OLS models testing a two-way (child care type * low income adequacy) interaction (not shown), there was one significant interaction whereby care by a non-relative (relative to no care of this type) was associated with an increase in BMI percentile between age 2/3 years and age 6/7 years for girls in low-income adequacy households (coefficient for interaction term from adjusted model: 0.32; 95% confidence interval [CI] = 0.016 to 0.62, p = .039).

Results of binary logistic regression (to examine the odds of moving into or out of the at-risk BMI percentile range by age

Abbreviations: BMI, body mass index; SD, standard deviation.

[a] $\geq$ 10 hours/week of child care.

[b] Sum of percentages for care variables exceeds 100 because more than one type of child care could be reported.

[c] Household income adequacy is a standard Statistics Canada classification based on household income and household size.

[d] Nova Scotia and Prince Edward Island combined due to small sample size for these provinces.

[e] Survey cycle refers to when child was enrolled in the study (cycle 1, enrolled in 1994; cycle 2, enrolled in 1996). Percentages within variables may not add up to 100 due to rounding.

TABLE 2A
Results of OLS regression analysis for girls (n = 1760), with BMI percentile change (continuous variable) regressed on child care type and socio-demographic variables

Predictor variable	Unadjusted estimates[a] coefficient (95% CI)	Adjusted model[b] coefficient (95% CI)
Child care [c]		
By non-relative	−.042 (−.13 to .04)	−.040 (−.13 to .05)
By relative	−.014 (−.11 to .09)	−.006 (−.10 to .09)
Daycare centre	.060 (−.063 to .18)	.056 (−.07 to .18)
Household income adequacy (Reference: lower)		
Middle	.014 (−.09 to .12)	−.003 (−.13 to .12)
Higher	−.022 (−.12 to .08)	−.050 (−.18 to .08)
Household education (Reference: < high school graduation)		
Some post-secondary	−.017 (−.12 to .08)	−.001 (−.11 to .10)
Post-secondary graduation	.001 (−.09 to .09)	.017 (−.09 to .12)
Number of siblings (Reference: 0)		
1	−.054 (−.15 to .04)	−.052 (−.14 to .04)
> 2	−.065 (−.18 to .04)	−.073 (−.18 to .03)
Number of parents in household (Reference: 2)		
1	−.025 (−.14 to .09)	−.047 (−.20 to .10)
Birth weight (Reference: normal)		
Low / very low (< 2500 g)	.064 (−.08 to .21)	.050 (−.09 to .19)
Mother's age at birth, years (Reference: 20–34)		
13–19 or 35+ (combined)[d]	.061 (−.054 to .18)	.068 (−.04 to .18)
Province of residence (Reference: Ontario)		
Newfoundland	−.040 (−.16 to .08)	−.049 (−.18 to .08)
Nova Scotia & Prince Edward Island[e]	−.063 (−.15 to .03)	−.066 (−.16 to .02)
New Brunswick	.040 (−.08 to .16)	.031 (−.09 to .15)
Quebec	.050 (−.06 to .16)	.034 (−.07 to .14)
Manitoba	.009 (−.12 to .13)	.009 (−.12 to .13)
Saskatchewan	−.020 (−.13 to .09)	−.018 (−.13 to .09)
Alberta	.084 (−.03 to .20)	.078 (−.03 to .19)
British Columbia	−.055 (−.15 to .04)	−.050 (−.15 to .05)
Urban/rural residence (Reference: urban)		
Rural	.010 (−.06 to .08)	−.000035 (−.07 to .07)
Survey cycle (Reference: cycle 2)[f]		
Cycle 1	.073 (.003 to .14)**	.066 (−.003 to .14)*

Abbreviations: BMI, body mass index; CI, confidence interval; OLS, ordinary least squares.

[a] Bivariate associations between each predictor variable and BMI percentile change, with the exception of child care and province of residence, for which all categories are entered as a block.

[b] Associations from single model containing all variables.

[c] > 10 hours/week of child care.

[d] The two high-risk age groups were combined to ensure adequate cell size for vetting.

[e] Nova Scotia and Prince Edward Island combined due to small sample size for these provinces.

[f] Survey cycle refers to when child was enrolled in the study (cycle 1, enrolled in 1994; cycle 2, enrolled in 1996).

* $p < .10$

** $p < .05$

6/7 years, among those in the normal and at-risk BMI percentile range at age 2/3 years, in relation to child care type) are shown in Table 3. No associations between child care and shift in BMI percentile range were observed for girls (Table 3a) or boys (Table 3b).

We observed few associations between socio-demographic covariates and BMI percentile. In girls with normal BMI percentile at age 2/3 years, those living in middle income status households were marginally less likely to move into the at-risk BMI percentile range by age

TABLE 2B
Results of OLS regression analysis for boys (n = 1804), with BMI percentile change (continuous variable) regressed on child care type and socio-demographic variables

Predictor variable	Unadjusted estimates[a] coefficient (95% CI)	Adjusted model[b] coefficient (95% CI)
Child care[c]		
By non-relative	.061 (−.02 to .14)	.10 (.02 to .18)**
By relative	−.037 (−.14 to .06)	−.021 (−.12 to .07)
Daycare centre	.031 (−.05 to .12)	.043 (−.05 to .13)
Household income adequacy (Reference: lower)		
Middle	−.010 (−.14 to .11)	−.061 (−.19 to .07)
Higher	−.077 (−.19 to .04)	−.18 (−.31 to −.05)***
Household education (Reference: < high school graduation)		
Some post-secondary	−.019 (−.13 to .10)	−.026 (−.15 to .10)
Post-secondary graduation	−.017 (−.10 to .07)	−.010 (−.11 to .09)
Number of siblings (Reference: 0)		
1	.019 (−.06 to .10)	.012 (−.07 to .09)
> 2	.014 (−.08 to .10)	−.020 (−.11 to .07)
Number of parents in household (Reference: 2)		
1	−.066 (−.21 to .08)	−.16 (−.33 to .002)*
Birth weight (Reference: normal)		
Low / very low (< 2500 g)	.074 (−.13 to .28)	.071 (−.12 to .27)
Mother's age at birth, years (Reference: 20–34)		
13–19 or 35+ (combined)[d]	−.051 (−.17 to .07)	−.052 (−.17 to .06)
Province of residence (Reference: Ontario)		
Newfoundland	−.074 (−.19 to .04)	−.11 (−.23 to .01)*
Nova Scotia & Prince Edward Island[e]	.037 (−.06 to .13)	−.00057 (−.10 to .10)
New Brunswick	.064 (−.08 to .21)	.027 (−.11 to .17)
Quebec	.034 (−.05 to .12)	.0038 (−.08 to .09)
Manitoba	.029 (−.09 to .15)	.011 (−.11 to .13)
Saskatchewan	.10 (−.02 to .22)	.070 (−.05 to .19)
Alberta	−.095 (−.21 to .02)*	−.11 (−.23 to −.0005)**
British Columbia	−.079 (−.21 to .05)	−.079 (−.20 to .04)
Urban/rural residence (Reference: urban)		
Rural	.034 (−.03 to .10)	.014 (−.05 to 0.08)
Survey cycle (Reference: cycle 2)[f]		
Cycle 1	.012 (−.05 to .07)	.020 (−.04 to .08)

Abbreviations: BMI, body mass index; CI, confidence interval; OLS, ordinary least squares.

[a] Bi-variate associations between each predictor variable and BMI percentile change, with the exception of child care and province of residence, for which all categories are entered as a block.

[b] Associations from single model containing all variables.

[c] > 10 hours/week of child care.

[d] The two high-risk age groups were combined to ensure adequate cell size for vetting.

[e] Nova Scotia and Prince Edward Island combined due to small sample size for these provinces.

[f] Survey cycle refers to when child was enrolled in the study (cycle 1, enrolled in 1994; cycle 2, enrolled in 1996).

* $p < .10$

** $p < .05$

*** $p < .01$

6/7 years than girls in a lower household income status (Table 3a). For boys, the following attributes were associated with a decrease in BMI percentile between age 2/3 years and age 6/7 years: higher household income adequacy, single parent household, residence in Newfoundland and residence in Alberta (Table 2b). Among boys who were in the normal

TABLE 3A
Results of binary logistic regression analysis for girls (n = 1760), with BMI percentile change regressed on child care type, unadjusted and adjusted for socio-demographic variables

Predictor variable	Girls with normal BMI[a] at age 2/3 years (n = 912)		Girls with at-risk BMI[b] at age 2/3 years (n = 848)	
	OR (95% CI) for moving into the at-risk BMI range by age 6/7 years		OR (95% CI) for moving into the normal BMI range by age 6/7 years	
	Unadjusted[c]	Adjusted[d]	Unadjusted[c]	Adjusted[d]
Child care[e]				
By non-relative	0.86 (0.51 to 1.40)	0.86 (0.49 to 1.50)	1.10 (0.67 to 1.80)	0.88 (0.50 to 1.50)
By relative	1.06 (0.50 to 2.30)	0.95 (0.45 to 2.00)	0.77 (0.42 to 1.40)	0.66 (0.35 to 1.20)
Daycare centre	1.82 (0.82 to 4.00)	1.66 (0.70 to 3.90)	0.64 (0.34 to 1.20)	0.55 (0.26 to 1.20)
Household income adequacy (Reference: lower)				
Middle	0.55 (0.28 to 1.10)*	0.43 (0.18 to 1.05)*	0.59 (0.30 to 1.10)	0.60 (0.28 to 1.30)
Higher	0.62 (0.31 to 1.20)	0.48 (0.18 to 1.30)	1.17 (0.64 to 2.10)	1.30 (0.61 to 2.90)
Household education (Reference: < high school graduation)				
Some post-secondary	1.12 (0.54 to 2.30)	1.21 (0.51 to 2.80)	1.40 (0.71 to 2.80)	1.27 (0.63 to 2.60)
Post-secondary graduation	0.71 (0.38 to 1.30)	0.77 (0.36 to 1.70)	1.50 (0.81 to 2.80)	1.36 (0.69 to 2.70)
Number of siblings (Reference: 0)				
1	0.72 (0.40 to 1.30)	0.73 (0.39 to 1.40)	0.67 (0.35 to 1.30)	0.60 (0.31 to 1.20)
2 or more	0.62 (0.32 to 1.20)	0.53 (0.25 to 1.20)	0.66 (0.31 to 1.40)	0.61 (0.28 to 1.30)
Number of parents in household (Reference: 2)				
1	0.96 (0.45 to 2.10)	0.55 (0.19 to 1.60)	1.08 (0.56 to 2.10)	1.12 (0.46 to 2.70)
Birth weight (Reference: normal)				
Low / very low (< 2500 g)	0.91 (0.37 to 2.20)	0.87 (0.34 to 2.30)	0.84 (0.29 to 2.40)	1.10 (0.38 to 3.20)
Mother's age at birth, years (Reference: 20–34)				
13–19 or 35+ (combined)[f]	0.71 (0.33 to 1.50)	0.75 (0.33 to 1.70)	0.82 (0.35 to 1.90)	0.71 (0.29 to 1.70)
Province of residence (Reference: Ontario)				
Newfoundland	1.76 (0.74 to 4.20)	1.41 (0.52 to 3.80)	0.72 (0.31 to 1.70)	0.69 (0.29 to 1.70)
Nova Scotia & Prince Edward Island[g]	1.01 (0.48 to 2.10)	0.96 (0.44 to 2.10)	1.27 (0.66 to 2.40)	1.41 (0.67 to 3.00)
New Brunswick	1.76 (0.76 to 4.10)	1.64 (0.67 to 4.00)	0.84 (0.43 to 1.60)	0.91 (0.44 to 1.90)
Quebec	1.48 (0.78 to 2.80)	1.41 (0.73 to 2.80)	0.60 (0.31 to 1.20)	0.65 (0.32 to 1.30)
Manitoba	1.02 (0.31 to 3.30)	0.97 (0.29 to 3.20)	0.81 (0.41 to 1.60)	0.83 (0.39 to 1.70)
Saskatchewan	1.56 (0.76 to 3.20)	1.76 (0.82 to 3.80)	1.80 (0.88 to 3.60)	1.85 (0.81 to 4.20)
Alberta	0.92 (0.40 to 2.10)	1.03 (0.44 to 2.40)	0.81 (0.38 to 1.80)	0.87 (0.38 to 2.00)
British Columbia	0.78 (0.32 to 1.90)	0.84 (0.32 to 2.20)	1.35 (0.61 to 3.00)	1.39 (0.58 to 3.30)
Urban/rural residence (Reference: urban)				
Rural	1.20 (0.77 to 1.90)	1.06 (0.62 to 1.80)	0.95 (0.63 to 1.40)	1.04 (0.64 to 1.70)
Survey cycle (Reference: cycle 2)[h]				
Cycle 1	1.06 (0.67 to 1.70)	1.01 (0.61 to 1.70)	0.94 (0.60 to 1.50)	1.05 (0.64 to 1.70)

Abbreviations: BMI, body mass index; CI, confidence interval; OR, odds ratio.

[a] BMI < 85th percentile.

[b] BMI ≥ 85th percentile.

[c] Bi-variate associations between each predictor variable and BMI percentile change, with the exception of child care and province of residence, for which all categories are entered as a block.

[d] Associations from single model containing all variables.

[e] ≥ 10 hours/week of child care.

[f] The two high-risk age groups were combined to ensure adequate cell size for vetting.

[g] Nova Scotia and Prince Edward Island combined due to small sample size for these provinces.

[h] Survey cycle refers to when child was enrolled in the study (cycle 1, enrolled in 1994; cycle 2, enrolled in 1996).

* $p < .10$

TABLE 3B
Results of binary logistic regression analysis for boys (n = 1804), with BMI percentile change regressed on child care type, unadjusted and adjusted for socio-demographic variables

Predictor variable	Boys with normal BMI[a] at age 2/3 years (n = 918) OR (95% CI) for moving into the at-risk BMI range by age 6/7 years		Boys with at-risk BMI[b] at age 2/3 years (n = 886) OR (95% CI) for moving into the normal BMI range by age 6/7 years	
	Unadjusted[c]	Adjusted[d]	Unadjusted[c]	Adjusted[d]
Child care[e]				
By non-relative	1.01 (0.60 to 1.70)	1.47 (0.87 to 2.5)	0.73 (0.45 to 1.20)	0.75 (0.45 to 1.20)
By relative	0.60 (0.33 to 1.10)	0.68 (0.35 to 1.30)	0.84 (0.42 to 1.70)	0.78 (0.38 to 1.60)
Daycare centre	1.35 (0.60 to 3.00)	1.56 (0.63 to 3.90)	1.04 (0.46 to 2.40)	0.90 (0.38 to 2.10)
Household income adequacy (Reference: lower)				
Middle	0.89 (0.40 to 2.00)	0.88 (0.35 to 2.20)	0.94 (0.49 to 1.80)	0.83 (0.38 to 1.80)
Higher	0.45 (0.22 to 0.96)**	0.51 (0.18 to 1.40)	0.87 (0.47 to 1.60)	0.73 (0.33 to 1.60)
Household education (Reference: < high school graduation)				
Some post-secondary	0.75 (0.37 to 1.50)	0.84 (0.39 to 1.80)	1.96 (0.97 to 4.00)*	1.89 (0.87 to 4.10)
Post-secondary graduation	0.52 (0.28 to 0.95)**	0.64 (0.31 to 1.30)	1.34 (0.70 to 2.60)	1.33 (0.67 to 2.60)
Number of siblings (Reference: 0)				
1	1.06 (0.56 to 2.00)	1.12 (0.59 to 2.10)	0.80 (0.50 to 1.30)	0.81 (0.47 to 1.40)
> 2	1.67 (0.78 to 3.60)	1.60 (0.72 to 3.60)	0.71 (0.39 to 1.30)	0.67 (0.35 to 1.30)
Number of parents in household (Reference: 2)				
1	1.60 (0.58 to 4.50)	1.32 (0.29 to 6.10)	0.86 (0.41 to 1.80)	0.77 (0.32 to 1.90)
Birth weight (Reference: normal)				
Low / very low [<2500g]	0.23 (0.06 to 0.80)**	0.15 (0.03 to 0.69)**	1.51 (0.50 to 4.50)	1.18 (0.35 to 4.00)
Mother's age at birth (Reference: 20–34 yrs)				
13–19 or 35+ (combined)[f]	1.14 (0.49 to 2.60)	1.15 (0.44 to 3.00)	0.90 (0.44 to 1.80)	0.97 (0.44 to 2.20)
Province of residence (Reference: Ontario)				
Newfoundland	1.49 (0.61 to 3.70)	1.28 (0.47 to 3.50)	1.40 (0.64 to 3.10)	1.26 (0.56 to 2.80)
Nova Scotia and Prince Edward Island[g]	1.10 (0.47 to 2.60)	0.78 (0.29 to 2.10)	0.94 (0.46 to 1.90)	0.98 (0.46 to 2.10)
New Brunswick	1.83 (0.77 to 4.4)	1.80 (0.63 to 5.10)	1.15 (0.54 to 2.40)	1.11 (0.48 to 2.60)
Quebec	1.68 (0.85 to 3.30)	1.52 (0.77 to 3.00)	1.28 (0.69 to 2.40)	1.11 (0.60 to 2.10)
Manitoba	0.89 (0.37 to 2.10)	0.79 (0.30 to 2.00)	1.16 (0.50 to 2.70)	1.04 (0.41 to 2.70)
Saskatchewan	1.20 (0.60 to 2.40)	0.98 (0.46 to 2.10)	1.54 (0.75 to 3.10)	1.62 (0.73 to 3.60)
Alberta	0.92 (0.37 to 2.30)	0.87 (0.33 to 2.30)	1.61 (0.85 to 3.00)	1.48 (0.75 to 2.90)
British Columbia	1.47 (0.67 to 3.20)	1.67 (0.74 to 3.70)	1.93 (0.92 to 4.00)*	1.73 (0.78 to 3.80)
Urban/rural residence (Reference: urban)				
Rural	1.20 (0.73 to 2.00)	0.97 (0.56 to 1.70)	0.85 (0.55 to 1.30)	0.75 (0.47 to 1.20)
Survey cycle (Reference: cycle 2)				
Cycle 1	1.15 (0.73 to 1.80)	0.88 (0.55 to 1.40)	0.94 (0.61 to 1.50)	1.00 (0.65 to 1.60)

Abbreviations: BMI, body mass index; CI, confidence interval; OR, odds ratio.

[a] BMI < 85th percentile.

[b] BMI > 85th percentile.

[c] Column contains bi-variate associations between each predictor variable and BMI percentile change, with the exception of child care and province of residence, for which all categories are entered as a block.

[d] Column contains associations from single model containing all variables.

[e] > 10 hours/week of child care.

[f] The two high-risk age groups were combined to ensure adequate cell size for vetting.

[g] Nova Scotia and Prince Edward Island combined due to small sample size for these provinces.

[h] Survey cycle refers to when child was enrolled in the study (cycle 1, enrolled in 1994; cycle 2, enrolled in 1996).

* $p < .10$

** $p < .05$

BMI percentile range at age 2/3 years, a low/very low birth weight was associated with reduced odds of moving into the at-risk BMI percentile range by age 6/7 years, relative to a normal birth weight (Table 3b).

Discussion

We examined the association between child care (three types) at age 2/3 years and change in BMI between age 2/3 years and age 6/7 years, using both OLS models (to capture change in BMI percentile regardless of starting point) and logistic regression models (to capture change that crosses a recognized threshold, the 85th BMI percentile). Although an association between child care and later BMI is plausible and would have policy relevance, its existence and nature in Canada is not known. To examine this association, we used a data source (NLSCY) that is well-suited to our question: the NLSCY is a longitudinal, nationally representative survey that contains information on several types of child care, height and weight data from multiple time points, and sufficient sample size to stratify by sex. While other studies included sex as a covariate,[16,19,21,22] ours is unique in that we examined the child care–BMI relationship in boys and girls separately.

For boys, care by a non-relative, for example, by a nanny, a baby-sitter, an informal day-home, a friend, or a neighbour, was associated with an increase in BMI percentile between age 2/3 and age 6/7 years. Although the reason for the association is not known, the appearance of this main effect in boys but not girls brings to mind a plausible role of non-relative caregiver behaviour such as providing sugary treats as a way of placating energetic boys or distracting them with television, thereby increasing sedentary behaviour. Although a statistically significant effect of this care type was not observed in logistic regression models, we note that the direction of the effect in the logistic regression model in boys is consistent with the OLS finding (Table 3b, adjusted models, odds ratio (OR) for boys with normal BMI percentile at age 2/3 moving into the at-risk BMI percentile by age 6/7 was 1.47, whereas OR for boys with at-risk BMI percentile at age 2/3 years moving into the normal BMI percentile by age 6/7 was 0.75). For girls, no main effects of child care on BMI percentile were apparent; however, the model containing interaction terms revealed that care by a non-relative was associated with an increase in BMI percentile between age 2/3 years and age 6/7 years among girls from low-income adequacy households. One possible explanation for this finding is that families with lower income, who have a financial imperative to work outside the home, may have a limited array of child care options from which to choose, and in some cases may have to resort to care options that are sub-optimal in terms of nutrition and opportunities for physical activity / active play. It is not known why the interaction effect was not observed in boys. The child care effects observed (main effect of care by non-relative in boys, interaction between care by non-relative and low income adequacy status in girls) differed only negligibly between the adjusted and the unadjusted models, suggesting that the socio-demographic correlates included were neither confounders nor mediators.

Although existing studies on child care and BMI vary in terms of population, age group, duration, and country, we can nonetheless comment on how our findings fit with and build on the existing literature. Several studies found an association between various types of "informal" care and weight gain / increase in BMI.[17,18,20] Our findings are consistent with these effects, and build on them. We identified non-relatives as a pertinent dimension of informal care with relevance to BMI in the Canadian context. The effect of informal care on increased risk of overweight observed by Pearce et al.[20] was specific to children from more advantaged backgrounds, while we observed that care by a non-relative was associated with increasing BMI percentile among girls from a lower income adequacy household. Collectively, findings from our study and others indicate that future research on the topic should take a nuanced view of informal child care – including whether the caregiver is a relative or not, the socio-economic circumstances of the child's family and the child's gender.

Our findings are consistent with those of Maher et al.,[17] Benjamin et al.[18] and Kim et al.[19] (all based on samples of U.S. children) in terms of finding no association between formal centre-based care and BMI outcomes. Although on the one hand it is good news that formal daycare does not appear to have a clear adverse effect on BMI, the absence of effect (particularly in the logistic regression models) also suggests a potentially under-exploited opportunity for health promotion. As noted, the number of young children in Canada with mothers in the paid labour force far exceeds the number of spots available in formal high-quality, affordable and accessible child care settings.[5] Many families accordingly rely on other care options, including care by a non-relative, which we observed to have an adverse effect on later BMI. Were it more widely available and accessible, it is plausible that at least some of the families currently using informal care options would opt for the formal high-quality daycare. To the extent that this care is indeed higher in quality, it could provide a more favourable environment for BMI and other outcomes. A strong case for investment in formal centre-based care requires ongoing high-quality research that examines the implications of formal centre-based care (including variants and attributes thereof) for diverse outcomes (health, social, economic) at different levels (child, family, community) over the short and particularly the longer term.[29-31]

Limitations

Our study suffers from some methodological limitations. One issue is the relatively large amount of missing data on the BMI variable. Our comparison of respondents with missing and non-missing BMI data indicated clear socio-demographic differences between the groups, though it is reassuring that the groups did not differ dramatically in terms of child care use (and not at all in the case of girls). Second, because all of our baseline data were reported at age 2/3 years, it is impossible to ascertain that BMI at age 2/3 had not already been affected by child care at age 2/3; however, we would argue that the nature of these associations is such that

immediate influence is unlikely. A third and particularly important limitation of the data is the parent-reported nature of children's heights and weights. The errors that parents commit in reporting height and weight of their children tend to result in overestimation of BMI, and these errors are larger for younger children and decline with increasing age.[32,33] One way to explore the potential implications of reporting inaccuracy for our findings is to examine correlates of reporting inaccuracy; in particular, socio-demographic attributes that are likely to be associated with child care use. Shields et al.[33] examined the association between parental education and reporting inaccuracy among children aged 6 to 11 years in the Canadian Health Measures Survey (CHMS): the CHMS is the only population-based dataset of Statistics Canada that contains both measured and parent-reported height and weight data for the same children. They found no association between parent education and reporting inaccuracy. Although the age group in the CHMS is older than our age group of interest (unfortunately, no Canadian national population-based data are available that contain both measured and parent-reported height and weight data for children of pre-school age), the findings of Shields et al.[33] support the view that parents' reports of their child's height and weight are not irredeemably biased by parents' education (one aspect of socio-economic circumstances), which heightens our confidence in our findings to some extent.

In summary, among children in the inaugural NLSCY cohort, care by a non-relative was associated with an increase in BMI over time for all boys and for girls from low-income adequacy households. Considering the high and growing demand for child care options,[6] the demonstrated benefits of high-quality formal child care for child social and health outcomes,[5,29-30] and the potentially adverse effects of certain informal forms of child care observed in this study and reported by others,[17,18] our findings contribute to a growing knowledge base with significant policy relevance, for which more research is needed.[29-31] In terms of research on child care and weight-related outcomes specifically, measured height and weight data are essential.

Acknowledgements

This project was funded by grant #820-2008-1019 from the Social Sciences and Humanities Research Council of Canada (SSHRC) awarded to McLaren, Auld and Emery and an Establishment Grant from Alberta Innovates – Health Solutions awarded to McLaren.

L. McLaren is supported by a Population Health Investigator Award from Alberta Innovates – Health Solutions. D. Dutton is supported by a Doctoral Traineeship from the Canadian Population Health Intervention Research Network (PHIRNET). M.C. Auld is supported by a Health Scholar Award from the Alberta Innovates – Health Solutions. J.C. Herbert Emery holds the Svare Professor in Health Economics at the University of Calgary.

Conflict of interest: none.

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Self-management, health service use and information seeking for diabetes care among recent immigrants in Toronto

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This article has been peer reviewed.

Abstract

Introduction: Our objective was to explore self-management practices, health services use and information-seeking for type 2 diabetes care among adult men and women from four recent immigrant communities in Toronto.

Methods: A structured questionnaire was adapted for the Canadian context and translated into 4 languages. A total of 184 participants with type 2 diabetes—130 recent immigrants and 54 Canadian-born—were recruited in both community and hospital settings.

Results: Recent immigrants were significantly less likely than the Canadian-born group to perform regular blood glucose and foot checks and significantly more likely than the Canadian-born group to be non-smokers, participate in regular physical activity and reduce dietary fat. Recent immigrants were significantly less likely than the Canadian-born group to use a specialist, alternative provider and dietician and less likely to report using dieticians, nurses and diabetes organizations as sources of diabetes-related information. Important differences were observed by sex and country of origin.

Conclusion: Findings suggest that diabetes prevention and management strategies for recent immigrants must address linguistic, financial, informational and systemic barriers to information and care.

Keywords: type 2 diabetes, self management, utilization of health services, information-seeking, immigrants, racialized groups

Introduction

About 5% of the Canadian population is living with type 2 diabetes,[1] and this proportion is expected to increase to 11% by 2020.[2] The prevalence of diabetes is also rapidly increasing among Canadian immigrants,[3] with pronounced variation across ethnicity and country of origin.[4,5] Recent immigrants and refugees from South Asia, Latin America, the Caribbean and sub-Saharan Africa have a two- to three-times greater risk of developing diabetes than their counterparts from western Europe or North America.[6] Moreover, this elevated risk begins earlier in life (i.e. from 20 to 40 years of age), compared with immigrants from Europe and North America and Canadian-born populations.[6]

Evidence suggests that recent immigrants do not always benefit from diabetes management programs[7,8] due to informational, financial, linguistic, cultural and systemic barriers to health and diabetes care.[9,10] Adherence to self-management activities and the use of health services for diabetes-related information and care varies across ethno-racial populations and among those who integrate to a host society.[4,11–14]

Our study reports findings related to self-management practices, health services use and help-seeking patterns among immigrants with diabetes in Canada.* As this was an exploratory study, no hypotheses were specified; however, the literature suggests that seeking information about diabetes and diabetes care may be compromised among recent immigrants. In particular, our key research question was how the migration process and being new to Canada affects diabetes

* In 2008, the Public Health Agency of Canada (PHAC) commissioned a survey in two large Canadian urban centres (Toronto and Montreal) to explore the experiences of recent immigrants (less than 10 years in Canada) with type 2 diabetes. This research was part of an international collaborative study on migration and diabetes co-ordinated by the International Centre for Migration and Health in Geneva, Switzerland.

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self-management and care. Our findings have implications for the development of health- and community-based interventions to enhance informational outreach, support self-management activities and facilitate access to diabetes care for newcomer populations in Canada.

Methods

The research team adapted a survey instrument developed by the International Centre for Migration and Health (ICMH) to collect information on the experiences of immigrants with type 2 diabetes. This involved extensive consultation with representatives of immigrant-serving organizations, diabetes education centres and community health centres. The final questionnaire was pre-tested and translated into four languages: Mandarin, Tamil, Bengali and Urdu. Ethics approval was obtained from University of Toronto, Mount Sinai Hospital and St. Michael's Hospital, in Toronto, Ontario.

Sample sizes and eligibility criteria for age and length of stay were pre-established by the Public Health Agency of Canada in order to ensure consistency with those used by other countries participating in the ICMH migration and diabetes study. The study population consisted of recent immigrant (less than 10 years in Canada) and Canadian-born adults (aged 35 to 64 years) with self-reported type 2 diabetes. This temporal definition of *recent immigrants* has been used in other provincial and national studies of Canadian immigrants.[15–17] Four newcomer communities were targeted based on the following criteria: risk of developing diabetes post-migration; current immigration trends; the presence of social, economic and linguistic barriers to care; and pre-existing relationships with the research team that would facilitate recruitment and optimize participation.

We used several techniques to recruit participants. Census data from 2006 were used to identify census tracts in the Greater Toronto Area where more than half of the population spoke one of the four study languages. These neighbourhoods were targeted for information campaigns about the study, and participants were recruited via posters in buildings, stores and community centres. A convenience sample of recent immigrant participants was also recruited via information sharing at community health centres, diabetes education centres and immigrant-serving organizations. To recruit Canadian-born study participants from across the city, we relied on existing partnerships with community health centres, diabetes education centres and hospital-based diabetes clinics located across the city as well as the Canadian Diabetes Association. Interested participants called the research co-ordinator first and were screened to determine their eligibility for the study. Others were approached in the clinics by the research co-ordinator or peer researchers.

All potential participants were then contacted by the project co-ordinator or a peer researcher fluent in their language who explained the aims of the study as well as the risks and benefits of participation. If the potential participant agreed to participate, an interview was arranged at a mutually convenient time and place. Consent forms were translated into each of the study languages. The interviews were conducted in the participant's language of choice using computer-assisted personal interviewing. This methodology for data collection was chosen because of its great potential to eliminate or minimize human errors, contribute to standardization of survey administration, enhance the efficiency of data collection and improve general data quality and validity. It also allows for more complex questionnaire structures and flexibility in design by incorporating skip patterns and automatic fill-in options. Since respondents cannot record implausible or "out-of-range" responses, all inconsistencies can be identified and resolved during the interview.[18,19] SPSS Data Entry Builder 4.0 software (SPSS Inc., Chicago, IL, US; 2003) was used to create the computer-assisted personal interviewing. Two members of the research team (AR, DK) developed this methodology for the Wave II data collection of the New Canadian Children and Youth Study (NCCYS) and have since used it—and shared it—across multiple projects.

Measures

Apart from age, which was treated as continuous, many of the sociodemographic variables in the survey were dichotomized due to small sample sizes: sex (male, female), current marital status (married/living with partner, not married), level of education (no university degree, university degree or higher), employment (employed, not employed), type of employment (permanent, temporary) and job reflecting education and credentials (yes, no). Income was calculated from the estimate of household income from all sources and number of people dependent on household income,[20] and later dichotomized as low income (yes, no). Racialized status[†] was determined by asking participants with which ethnic or racial group they best identified, with responses dichotomized (racialized, non-racialized) according to their self-response.

Variables regarding self-management practices were based on behaviours defined in the research literature as important to self-management.[22] The survey participants were asked questions about the frequency with which their blood glucose is checked ("How often do you usually have your blood checked for glucose or sugar either by yourself or by a family member or friend? Yes daily/weekly glucose check, no"); the frequency that their feet are checked for sores or irritations ("How often do you usually have your feet checked for any sores or irritations by yourself or a family member or friends? Yes daily/weekly foot check, no"); their smoking status ("At the

[†] The research team adopted the term *racialized status* (as opposed to *visible minority status*) in this project to acknowledge the fact that *racialization* is a social process whereby certain groups come to be designated as different and consequently subjected to differential and unequal treatment.[21] Unlike the term *visible minorities*, which Canada's *Employment Equity Act* defines as "non-Caucasian in race or non-white in colour," *racialized groups* makes clear that race is not an objective biological fact, but rather a social and cultural construct that potentially exposes individuals to prejudicial attitudes and discriminatory treatment.

present time, do you smoke cigarettes? Yes, no"); their physical activity ("Do you usually do some physical activity for at least 30 minutes per day? Yes, no"); and their diet ("During the past 12 months, to what extent have you tried to reduce carbohydrates (pasta, bread)? A great deal or moderately, only a little or not at all").

Items regarding use of health services included eye examinations ("Have you ever had an eye exam for diabetes where the pupils of your eyes were dilated? Yes, no"); checking for sores or irritations ("In the past 12 months, has a health care professional checked your feet for any sores or irritations? Yes, no"); and blood indicators ("In the past 12 months, has a health care professional tested you for hemoglobin A1C? How many times?" Every 3 months, not every three months).[‡]

Questions about information-seeking practices included, "Who provides you with information about managing your diabetes (physician, dietician, nurse, family or friends, diabetes association, Internet)? Participants were able to indicate more than one source. The survey instrument also included a series of questions on barriers to accessing health care including finding a doctor who was accepting new patients, long waits to see a family doctor or specialist, not knowing where to go for health care, linguistic barriers, finding child care, transportation problems, time off work, gender issues and costs not covered by health insurance.

Statistical analyses

Bivariate analyses (Student's *t* tests, Chi-square tests) were used to compare the recent immigrant and Canadian-born study groups, and to explore possible variations within the recent immigrant group itself by country of origin and sex. Statistical significance was set at $p < .05$.

Results

Survey data was collected from 184 participants with type 2 diabetes using convenience sampling. Of these, 130 were recent immigrants from Sri Lanka (n = 30), Bangladesh (n = 35), Pakistan (n = 35) and China (n = 30), and 54 were Canadian-born respondents. In the recent immigrant group, 58 (45%) were men and 72 (55%) were women, compared with 28 men (52%) and 26 women (48%) in the Canadian-born group. All participants in the recent immigrant group were racialized. About 76% of the Canadian-born group was non-racialized, an identical proportion to that reported among the Canadian-born population in Toronto.[23]

Demographic information describing the study participants is shown in Table 1. Recent immigrants were three times more likely to be married than the Canadian-born respondents, but less likely to have a permanent job or a job that reflected their educational credentials and experiences. There were no significant differences between groups in terms of mean age, education or employment status. The incidence of low income was notably high among recent immigrants (36%) as well as those who were Canadian-born (42%), but the difference between the two groups was statistically nonsignificant. Some significant differences were, however, noted within the recent immigrant group by sex and country of origin. For example, recent immigrant women had completed lower levels of education, were less likely to be employed and were less likely to be permanently employed than recent immigrant men.

Figure 1 shows data on the five diabetes self-management variables by migration status. The recent immigrant group was less likely than the Canadian-born group to perform regular glucose checks (76.2% vs. 90.8%, $p < 0.001$) and foot checks (57.0% vs. 75.9%, $p < .001$). Recent immigrants were more likely than the Canadian-born to be non-smokers (10.0% vs. 35.2%, $p < .001$), participate in regular physical activity (81.5% vs. 66.7%, $p < .05$) and reduce carbohydrates moderately or a lot (76.2% vs. 51.9%, $p < .001$). Statistically significant differences by sex and country of origin were also observed. Recent immigrant women were significantly less likely than recent immigrant men to be smokers,

TABLE 1
Demographics: recent immigrant and Canadian-born study groups

	Recent immigrants (N = 130)	Canadian-born adults (N = 54)	*p* value	Significant differences	
				By sex ($p < .05$)	By country of origin ($p < .05$)
Mean age, years	51.2	52.3	NS		Yes
Marital status					
Married, %	89.2	24.1	< .001		
Education					
University or higher, %	52.3	35.2	NS	Yes	Yes
Employment					
Unemployed, %	33.8	29.6	NS	Yes	
Type of employment					
Permanent, %	60.0	94.4	< .01	Yes	
Job reflects credentials					
No, %	41.3	0	< .01		
Income					
Low income, %	36.3	41.9	NS		
Race					
Racialized, %	100	24.1			

Abbreviation: NS, non-significant.

[‡] The time frames indicated are the minimum periods recommended for diabetes care. For example, if a problem such as a retinopathy is found, more regular eye exams would be indicated.

whereas recent immigrants from Pakistan were more likely to check their glucose and feet and engage in regular physical activity than recent immigrants from other countries (data not shown).

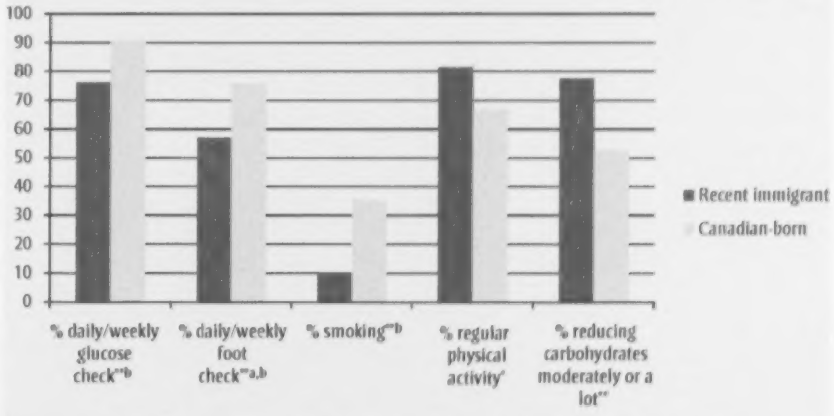
Figure 2 shows data on the utilization of health care professional services for diabetes care. Similar proportions of the recent immigrant group and the Canadian-born group ever had an eye exam (66.2% vs. 75.9%) and had their hemoglobin A1C level checked every three months (17.1% vs. 24%). However, recent immigrants were more likely to have never had a foot exam compared with the Canadian-born participants in our study sample (60.0% vs. 33.3%, $p < .001$).

Table 2 presents data on the reported usual sources of diabetes care and information. While both groups reported using general practitioners or family physicians as their usual source of health care, recent immigrants were significantly less likely to consult a specialist (24.6% vs. 40.7%, $p < .05$), alternative health care provider (0.8% vs. 7%, $p < .05$) or dietician (19.2% vs. 38.9%, $p < .01$). Some significant differences were observed by sex and country of origin. Recent female immigrants were, for example, more likely to use a dietician than recent male immigrants (data not shown).

Although both groups reported that physicians were their primary source of information on diabetes, compared with the Canadian-born respondents, recent immigrants were significantly less likely to report using dieticians (24.6% vs. 40.7%, $p < .05$), nurses (11.5% vs. 24.1%, $p < .05$) and diabetes associations (2.3% vs. 24.1%, $p < .001$) as sources of information. They were also significantly more likely to use family (46.9% vs. 27.8%, $p < .05$) and friends (39.2% vs. 13.0%, $p < .001$). There was no statistically significant difference between groups regarding Internet use for this purpose (28.5% vs. 29.6%).

When asked about the types of barriers experienced in accessing health care, recent immigrants reported significantly more problems than did their Canadian-born counterparts, indicating long waits to see doctors or specialists, a lack of information on where to go, linguistic barriers, child care issues, difficulties finding a doctor of the same sex, and dealing with costs not covered by insurance (data not shown). Several of these barriers were more significant for recent immigrant women compared with recent immigrant men.

FIGURE 1
Diabetes self-management practices by recent immigrant and Canadian-born study groups



[a] Significant differences by sex.

[b] Significant differences by country of origin.

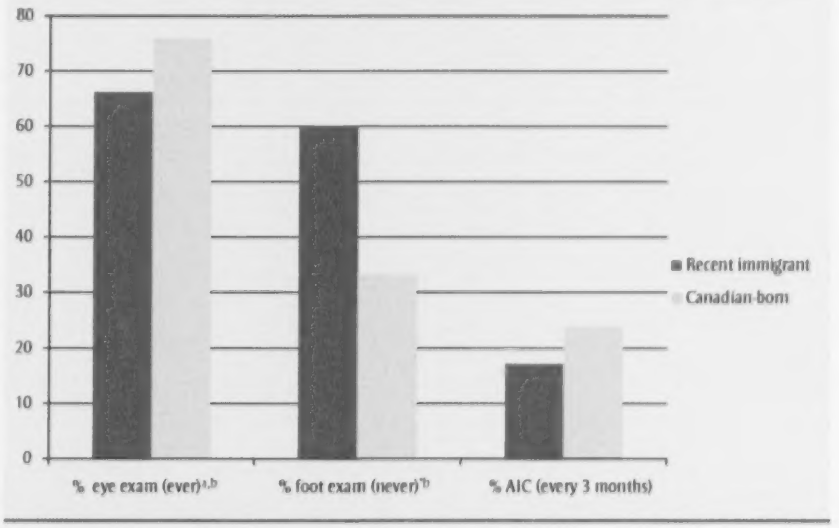
*$p < .05$.

**$p < .001$.

Discussion

This survey was the first in Canada to collect information on the experiences of

FIGURE 2
Use of health services for diabetes care by recent immigrant and Canadian-born study groups



Abbreviation: AIC, hemoglobin A1C.

[a] Significant difference by sex.

[b] Significant differences by country of origin.

*$p < .001$.

TABLE 2
Sources of diabetes health care and information for recent immigrant and Canadian-born study groups

	Recent immigrants (N = 130)	Canadian-born (N = 54)	*p* value	Significant differences	
				By sex	By country of origin
Usual source of care, %					
GP or FP	95.4	85.3	< .1		
Specialist	24.6	40.7	< .05		Yes
Social worker	2.3	1.9	NS		
Alternative health care provider	0.8	7.4	< .05		
Dietician	19.2	38.9	< .01	Yes	Yes
Nurse educator	12.3	22.2	NS		
Main source of information, %					
MD	89.2	96.3	NS		
Dietician	24.6	40.7	< .05		
Nurse	11.5	24.1	< .05		
Social worker	5.4	0	NS		
Family	46.9	27.8	< .05		Yes
Friends	39.2	13.0	< .001	Yes	Yes
Diabetes associations	2.3	24.1	< .001		
Internet	28.5	29.6	NS		Yes

Abbreviations: FP, family physician; GP, general practitioner; MD, medical doctor; NS, non-significant.

recent immigrants with diabetes in their own language. We purposefully sampled high-risk newcomer populations and, with our recruitment strategies, we most likely ended up oversampling individuals from low-income backgrounds. This was not intentional but simply reflects the economic realities of recent immigrants. As the proportion of low income was similarly high (over one-third) among both recent immigrant and Canadian-born study groups, our analyses were able to identify some differences, over and above absolute income, regarding demographics, self-management practices, the use of health services information and information seeking.

Among the differences that were observed between recent immigrant and Canadian-born adults with diabetes were differences in type of employment and underemployment. This is consistent with the literature documenting differences in these employment patterns between recent immigrant and Canadian-born individuals.[24] Furthermore, racialized Canadians (immigrant *and* Canadian-born) are more likely to be unemployed and less likely to have permanent employment than non-racialized Canadians.[21,25] Precarious status can have a negative impact on health care access particularly since it prevents access to insured services.[26,27] The fact that the unemployment rate among the Canadian-born group in our study (29.6%) was higher than that of the Canadian population as a whole is likely because the study population was composed of people with diabetes, a condition that has been shown to have a significant negative impact on employment probabilities.[28] In addition, diabetes is more prevalent in low-income populations.

In terms of self-management practices, the differences between recent immigrants and the Canadian-born groups were less clear cut. Recent immigrants were less likely to perform regular glucose or foot checks than the Canadian-born population. This suggests that recent immigrants may be experiencing informational barriers regarding optimal diabetes care. In our study group, recent immigrants with diabetes were less likely than their Canadian-born counterparts to use tobacco and more likely to engage in physical activity and healthy eating, positive practices that need to be encouraged and supported as an integral part of diabetes care. However, other research suggests that, whereas new immigrants are significantly less likely to smoke than the Canadian-born population, they are also less likely to engage in physical activity.[29–32]

This study identified informational and systemic barriers to health care faced by recent immigrants with diabetes, particularly for those from non-European backgrounds. Several other studies indicated that racialized Canadians, as most recent immigrants are, are less likely to use preventive, chronic and specialist health services than the Canadian-born population.[9,33–34]

It is possible that differences in the severity of diabetes between the recent immigrant and Canadian-born study groups might account for differences in self-management and health services use. However, both groups reported similar rates of under-control diabetes and of gestational diabetes. Rates of obesity (as determined by BMI and waist circumference) were significantly higher in the Canadian-born group compared with the recent immigrant group, and yet the latter reported more problems associated with their diabetes than did the Canadian-born group. Multivariate analyses are called for to examine in greater detail demographic and other risk factors associated with self-management practices, access to diabetes care and information seeking, and possible variations by sex and country of origin.

It is also possible that our findings reflect differences in racialized status rather than newcomer status since all of the recent immigrants in our study were racialized. Newcomer status, racialized status, country of origin, sex and other social determinants are all important and intersecting predictors of self-management and access to diabetes information and care that need to be considered by health care providers and decision makers in developing culturally and contextually sensitive models of diabetes care.

These issues will be further addressed in the second phase of our research in which we examine diabetes outcomes among recent, non-recent and Canadian-born members of the Black Caribbean community with type 2 diabetes.

Conclusion

While our results are not generalizable to the entire newcomer immigrant population due to small sample size and non-random sampling, these findings have important implications for the organization and delivery of diabetes prevention and management strategies in newcomer communities, particularly those that are economically marginalized and at high risk of developing diabetes. Diabetes prevention strategies must continue to address the social determinants of health, especially precarious employment, which may contribute to inequities in health and access to care. Health service delivery policies and strategies need to recognize the unique needs and barriers facing newcomer communities as a priority population that require financial, linguistic and gender-sensitive supports. The strong reliance of recent immigrants on family and friends for diabetes-related information suggests that raising community awareness and capacity with respect to diabetes is critical. Community information sharing networks and community-based informal and formal support systems should be considered as the foundation for diabetes prevention and health promotion strategies.

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Assessing the reach of nicotine replacement therapy as a preventive public health measure

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This article has been peer reviewed.

Abstract

Introduction: Access to Nicotine Replacement Therapy (NRT) is a key public health intervention to reduce smoking. We assessed prevalence and correlates of use of NRT in Ontario, where NRT is available without prescription.

Methods: Participants were a representative sample of 2262 adult smokers in the Ontario Tobacco Survey cohort. Prospectively measured use of NRT over a 6-month period was reported in relation to smoking behaviour and history, attempts to quit, receipt of other supports for cessation supports and attitudes toward NRT.

Results: Overall, 11% of smokers used NRT over the six-month follow-up period. Prevalence was 25% among the 27% of smokers matching clinical guidelines that recommend NRT as a therapeutic option, and low among smokers not trying to quit.

Conclusion: With increasing accessibility of NRT, further surveillance and research are warranted to determine the impact of the reach and benefits of NRT, considering both the general and targeted smoking populations.

Keywords: smoking cessation, nicotine, evidence-based medicine, population surveillance

Introduction

In trials, nicotine replacement therapy (NRT) nearly doubles the likelihood of smoking cessation,[1-3] and so has the potential to reduce the disease burden from tobacco.[4] Ensuring access to NRT is a required public health intervention for all nations, including Canada, that have signed the World Health Organization Framework Convention on Tobacco Control.[5,6] Several jurisdictions (e.g. Canada, United States, United Kingdom, Australia and much of Europe) have made NRT available over the counter (OTC) without prescription, while others propose to do the same.

Several authors have stated that measures to make NRT more available have increased its use,[7,8] while others argue it is still underutilized.[9-11] However, few reports have described uptake of NRT at population levels where these have been made available OTC.[12-14] The cost of NRT in Canada has been described both as a serious barrier[15] and a contribution to inequality in access to effective cessation services.[16] New publicly funded programs are being considered and enacted to increase access and use of this treatment.[17] The effectiveness of making NRT readily accessible should be evaluated with quantitative surveillance data on the size of the ideal target population as well as the proportion of the population reached by the intervention.[18] These data have not been available in Canada.

This report addresses a gap in knowledge about the size of the population of smokers representing unmet need for increased use of NRT in Ontario. There is some controversy about whether all, or only specific, smokers should be encouraged to use NRT, and if medication is over-promoted to smokers who do not need it to quit.[19] Therefore, we report on prevalence of NRT use in all smokers and those matching *de jure* guidelines applied in programs providing publicly funded NRT in Ontario[20] and elsewhere[1,21] to quantify reach of this preventive measure in smokers representing targeted and not targeted users. Targeting criteria used are drawn from evidence-based reviews,[22] including Cochrane reports [1,2] and meta-analyses.[23,24] These have concluded that there is strong evidence of the benefit of NRT for smokers who are both nicotine dependent (largely defined as consuming more than 10 to 15 cigarettes per day) and motivated to quit smoking.[1,2] It is also recommended as a best practice that NRT users receive behavioural counselling, to achieve the additive effects of both interventions.[1,2,22] Authors who advocate that NRT is suited to all smokers without restrictions[8,11,25] argue that NRT may be effective without clinical help and that

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the number of cigarettes smoked per day may not correlate with the presence or severity of withdrawal symptoms targeted by the medication or the perceived need for the medication.[11,24-33] Others have suggested there may be increased use of NRT for reasons other than quitting (e.g. to postpone quitting or to cut down but continue smoking), and they have indicated a need to monitor such potential trends.[34-38]

Evidence for the effectiveness of NRT obtained OTC also remains weaker than for clinical settings. This will depend on who uses it and how it is used, which makes patterns of NRT use important to monitor.[39]

Methods

Study population and design

We conducted our research in Ontario, Canada, a province with a comprehensive Tobacco Control Strategy. Throughout the study period, NRT patch and gum forms were readily available OTC at pharmacies, grocery stores and convenience stores. No other forms of NRT (e.g. inhaler, lozenge) were licensed for use, and NRT products were licensed for use in immediate cessation (i.e. not to be used while still smoking or quitting gradually). Most OTC products were paid for privately[40] and not covered in universal drug benefits.

Data were from the Ontario Tobacco Survey, a population-representative telephone survey and panel study of adult smokers[41,42] recruited from July 2005 through June 2007 (for whom NRT attitude questions were included in the interview). Of 2681 smokers at baseline (daily or occasional smokers who had smoked within 30 days and 100 or more cigarettes in their lifetime), 2262 had complete baseline and first six-month follow-up data (84.4% retention). Approximately 12% of the sample were studied during a time when they could have been eligible for a free, government-funded NRT distribution program.[20]

The University of Toronto and the University of Waterloo provided ethical approval to conduct and use the data from the Ontario Tobacco Survey.

Study variables

Respondents were asked at baseline if they had ever or never previously used NRT. At the six-month interview, respondents were asked if they had used either the nicotine patch, gum or inhaler in the preceding six months "to quit or reduce smoking." We defined six-month period prevalence of NRT use as any use of NRT during follow-up, regardless of history.

A number of smokers' characteristics were considered as predictors of NRT use. These included factors known to be associated with quit attempts and measures derived to reflect practice guidelines around NRT (intention to quit; indications of nicotine dependence assessed through consumption level, typically 10 or more cigarettes; and receipt of behavioural supports for cessation). Six-month intention to quit smoking was obtained at baseline by asking, "Are you planning to quit smoking within the next month, within the next six months, sometime in the future, beyond six months, or are you not planning to quit?"[43,44] A second derived covariate classified smokers as intending to quit if they intended to do so at baseline or reported having made a serious attempt to quit during the six-month follow-up. We calculated baseline consumption, time to first cigarette after waking[45] and Heaviness of Smoking Index.[46] Respondents were also asked if they considered themselves "very," "somewhat" or "not at all" addicted to cigarettes.[47] Derived variables were also created for combinations of indications for NRT (defined as above).

Respondents' confidence in their ability to quit was measured in four levels from "not at all" through "very confident" that they would succeed if they decided to quit completely in the next six months. Reports of having made a serious attempt to quit smoking, having received physician advice to quit smoking and using specific behavioural supports for cessation were obtained at baseline and follow-up. Attitudes toward pharmaceutical smoking cessation aids were determined at baseline from agreement with the following statements: "stop-smoking medications make it easier to quit than trying to quit on your own"; "the cost of stop-smoking medications makes it difficult to use them"; "stop-smoking medications are hard to get"; and "the risk of side effects from stop-smoking medications concerns you." The demographic characteristics considered were age, sex, education and rural residence.[48] Rural residence was considered as a potential indicator of relatively poorer access to NRT (due to any of the following: limited access to primary care providers who might recommend pharmacotherapy; larger distances to pharmacies that carry the product; or greater cost of the product in more remote locations).

Analyses

Use of NRT was reported in bivariate analyses and multivariable models relating NRT use to smoker demographics, baseline attitudes and smoking characteristics and to behaviours related to smoking cessation.

We obtained prevalence ratios for NRT use in relation to covariates using log-binomial regression models including all smokers. We restricted this to smokers who reported making a quit attempt during the six-month follow-up period. Regression diagnostics included assessment for non-linearity and multi-colinearity. All descriptive and multivariable analyses used sampling weights for the Ontario Tobacco Survey smoker cohort, which were calculated to produce estimates representative of the underlying population of Ontario adult recent smokers at baseline.[41] Variance estimates took the sampling design into account and were obtained using the Taylor series expansion methods in Stata version 11 (StataCorp LP, College Station, TX, United States).[49]

Results

Table 1 presents the characteristics of 2262 respondents with complete six-month follow-up data, along with six-month prevalence of NRT use by smoker characteristics, predictors of cessation and attitudes toward NRT. Similarity of the sample to the underlying population is

TABLE 1
Sample characteristics and prevalence of NRT use in six months by smoker characteristics, in a population-representative cohort of adult smokers, Ontario, Canada

Characteristic of smoker, history of smoking and cessation attempts, and attitudes	Unweighted sample size, n	Percent of sample, weighted	Prevalence of NRT use in 6 months, by group	
		%	%	95% CI
All smokers with complete 6 month data	2262	100	11.4	9.7–13.1
Demographics				
Age, years	2261			
18–34	592	33.4	11.0	7.8–14.2
35–54	1120	49.1	12.2	9.8–14.6
55+	549	17.4	10.1	7.0–13.1
Sex	2262			
Male	993	52.5	11.2	8.8–13.6
Female	1269	47.5	11.7	9.4–13.9
Education	2256			
Some post-secondary education	1178	54.5	13.0	10.6–15.3
High school or less	1078	45.5	9.6	7.3–11.9
Heaviness of smoking at baseline				
Number of cigarettes smoked/day[a]	2239			
0–9	695	36.4	9.3	6.3–12.2
10–15	568	25.1	15.1	11.1–19.0
16+	976	38.5	11.4	9.1–13.7
Time from waking to first cigarette, minutes	2256			
< 30	1300	51.5	12.4	10.2–14.6
> 30	956	48.5	10.2	7.7–12.8
Quit attempts and intentions				
Lifetime number of quit attempts at baseline[a]	2260			
0	321	16.7	6.4	2.1–10.6
1	514	23.2	8.2	5.3–11.0
2	506	23.1	10.6	7.1–14.1
> 3	919	37.0	16.3	13.3–19.3
Intended to quit at baseline[a]	2230			
Yes	914	40.2	17.5	14.4–20.5
No	1316	59.8	7.6	5.6–9.5
Made a serious attempt to quit smoking during 6-month follow-up period (reported at follow-up)[a]	2098			
Yes	467	25.5	29.6	24.2–35.0
No	1631	74.5	3.9	2.9–4.9
Supports for cessation				
Lifetime history of NRT use[a]	2262			
Yes	1177	46.8	19.4	16.5–22.3
No	1085	53.2	4.4	2.6–6.2
Lifetime history of any behavioural supports (including physician advice)[a]	2262			
Yes	415	16.0	23.7	18.3–29.2
No	1847	84.0	9.1	7.4–10.8
Physician advice or use of behavioural supports during follow-up[a]	2235			
Either	959	43.6	17.2	14.1–20.4
Neither	1276	56.4	7.3	5.6–9.0

Continued on the following page

reported elsewhere.[41,42] In this cohort 64% smoked 10 or more cigarettes per day at baseline, and 52% reported smoking within 30 minutes of waking. Most respondents (83%) had previously tried to quit, and 47% had previously used NRT. In our sample, 40% reported an intention to quit smoking at baseline, which is somewhat lower than estimates from other sources for the same population (55%–59%,[50,51] although with different measures of intention[52]).

Between baseline and the first six-month follow-up, 11% reported using NRT (see Table 1). Overall, 26% reported making a serious quit attempt and just 2% of all smokers in the sample were first-time users of NRT in this six-month period. There was no detectable difference in NRT use among the 12% of respondents whose time on study coincided with a free NRT give-away program in Ontario (data not shown).

Table 1 also shows the prevalence of NRT use by smoker characteristics. Use was significantly higher among respondents who intended to quit altogether (using various measures), who made serious attempts to quit, and who had received behavioural or professional supports for cessation. NRT use was also positively associated with baseline cigarette consumption, lifetime number of quit attempts, prior use of NRT, perceived addiction, confidence in ability to quit and attitudes toward stop-smoking medications. Age, sex or education were not associated with NRT use; nor was rural/urban residence in our analyses (data not shown).

Among smokers who intended to quit altogether (either a prior intention to quit at baseline or a reported serious attempt during the follow-up period) and a baseline consumption of 10 or more cigarettes per day (the 27% of smokers meeting explicit practice guidelines), 25% used NRT. The highest prevalence of NRT use observed by subgroup, at 31%, was among smokers who exactly met the most conservative eligibility criteria and also reported past or recent receipt of behavioural support (Table 1).

TABLE 1 (continued)
Sample characteristics and prevalence of NRT use in six months by smoker characteristics, in a population-representative cohort of adult smokers, Ontario, Canada

Characteristic of smoker, history of smoking and cessation attempts, and attitudes	Unweighted sample size, n	Percent of sample, weighted	Prevalence of NRT use in 6 months, by group	
		%	%	95% CI
Attitudes and beliefs				
Perceived addiction[a]	2253			
Not at all	151	8.8	2.1	0.0–6.0
Somewhat	603	30.7	8.1	5.2–10.9
Very	1499	60.5	14.5	12.2–16.8
Confident of quitting altogether in the next 6 months[a]	2248			
Not at all confident	310	12.0	9.9	5.4–14.4
Not very confident	654	27.3	12.3	9.1–15.4
Fairly confident	753	33.8	14.4	11.0–17.7
Very confident	531	26.8	7.9	5.2–10.5
Stop-smoking medications make it easier to quit than trying to quit on your own[a]	2261			
Agree	1656	70.5	13.6	11.4–15.8
Disagree	494	24.8	6.8	4.2–9.4
Don't know	111	4.8	3.3	0.8–5.7
The cost of stop-smoking medications makes it difficult to use them[a]	2261			
Agree	1334	55.5	12.0	9.8–14.2
Disagree	771	37.0	12.4	9.4–15.4
Don't know	156	7.5	2.4	0.4–4.5
Stop-smoking medications are hard to get[a]	2262			
Agree	344	14.2	7.6	4.2–11.1
Disagree	1776	79.5	12.6	10.6–14.6
Don't know	142	6.3	5.3	1.2–9.5
The risk of side effects from stop-smoking medications concerns you[a]	2262			
Agree	1309	56.1	10.5	8.4–12.6
Disagree	840	38.5	14.2	11.1–17.3
Don't know	113	5.5	1.5	0.1–3.0
Combination of indications for NRT use				
Intention or attempts to quit plus 10+ cigarettes/day[a]	2206			
Yes	658	26.6	25.3	21.0–29.6
No	1548	73.4	6.5	4.8–8.1
Intention or attempts to quit plus 10+ cigarettes/day plus any support[a]	2223			
Yes	349	13.9	30.8	24.4–37.3
No	1874	86.1	8.3	6.7–10.0
Intention or attempts to quit plus any supports[a]	2212			
Yes	526	23.6	26.8	21.7–32.0
No	1686	76.4	6.8	5.3–8.2

Source: Ontario Tobacco Survey, Ontario Tobacco Research Unit, July 2005 to December 2007 (Cohorts 1 to 4 with 6-month follow-up data).

Abbreviations: CI, confidence interval; NRT, nicotine replacement therapy.

[a] Statistically significant bivariate association as indicated using global chi-square test for association.

Table 2 shows the characteristics and responses of the 301 individuals who used NRT in the six-month follow-up window. The large majority of NRT users had a history of quit attempts at the baseline interview (91%), expressed an intention to quit (as baseline intention to quit [61%] or attempt in follow-up [72%]), had used NRT at or before the baseline interview (80%) and reported themselves to be "very addicted" (77%). NRT users tended to believe stop-smoking medications made it easier to quit (84%) and that they were readily available (88%), but also that the cost made it difficult to use them (58%).

Table 3 shows the results of simultaneously adjusted log-binomial regression models predicting use of NRT during six-month follow-up among all smokers and among only those who reported attempting to quit during the same follow-up window. Demographic characteristics including age and education were not associated with NRT use after adjustment for smoking behaviour and history.

Among all smokers, history of quit attempts at baseline was unrelated to NRT use. However, respondents were over 6 times more likely to use NRT if they reported a serious attempt to quit smoking over the same six-month follow-up period; they were also more likely to use NRT if they had previously used it. Both a lifetime history of physician advice or behavioural supports for cessation and reported receipt of advice or support during the same follow-up window were statistically significant predictors of NRT use in the fully adjusted model. Consumption-based smoking behaviour measures at baseline (number of cigarettes per day and time to first cigarette) and confidence in ability to quit were not statistically significant after adjustment for history of quitting behaviour.

When the analysis of predictors of NRT use was restricted to smokers who made a serious attempt to quit in the six-month time frame, history of support for cessation was positively associated with NRT use. However, after adjustment for this, behavioural support reported during the same reference period was not related to

TABLE 2
Characteristics of a population-representative cohort of adult smokers who reported using NRT products "to quit or cut down" in a six-month follow-up period, Ontario, Canada

Characteristics of smokers (n = 301)		Weighted, %	95% confidence interval
Demographics			
Age, years	18–34	32.2	24.6–39.9
	35–54	52.4	44.7–60.1
	55+	15.4	10.7–20.0
Sex	Male	51.5	43.8–59.1
	Female	48.5	40.9–56.2
Education	Some post-secondary	61.8	54.2–69.3
	High school or less	38.2	30.7–45.8
Heaviness of smoking at baseline			
Number of cigarettes smoked/day	0–9	29.1	21.5–36.8
	10–15	32.8	25.4–40.2
	16+	38.1	31.1–45.2
Time from waking to first cigarette, minutes	< 30	56.4	48.5–64.2
	> 30	43.6	35.8–51.5
Quit attempts and intentions			
Lifetime number of quit attempts at baseline	0	9.3	3.3–15.4
	1	16.6	11.1–22.0
	2	21.3	14.8–27.8
	> 3	52.8	45.1–60.5
Intended to quit at baseline	Yes	60.8	53.0–68.5
	No	39.2	31.5–47.0
Made a serious attempt to quit smoking during the 6-month follow-up period (reported at follow-up)			
	Yes	72.3	65.5–79.0
	No	27.7	21.0–34.5
Supports for cessation			
Lifetime history of NRT use	Yes	79.6	72.4–86.8
	No	20.4	13.2–27.6
Lifetime history of any behavioural supports (including physician advice)			
	Yes	33.3	26.2–40.3
	No	66.7	59.7–73.8
Physician advice or use of behavioural supports during 6-month follow-up			
	Either	64.6	57.5–71.7
	Neither	35.4	28.3–42.5
Attitudes and beliefs			
Perceived addiction	Not at all	Suppressed[a]	Suppressed[a]
	Somewhat	21.6	14.8–28.4
	Very	76.7	69.6–83.8
Confidence of quitting altogether in the next 6 months			
	Not at all confident	10.3	5.7–15.0
	Not very confident	29.1	22.4–35.8
	Fairly confident	42.2	34.5–49.9
	Very confident	18.3	12.6–24.0

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NRT use. (Additional models, not shown, indicate substitution effect where either past or same-time period history of behavioural supports were positively associated with NRT use, and the two were correlated.) Unlike the associations found among all smokers, among those who made a quit attempt higher number of cigarettes per day at baseline was positively associated with reported use of NRT in the next six months, but not previous quit attempts. A "don't know" response to the attitude item about price of NRT was negatively correlated with use. Conversely a "don't know" response to the question on ease of access was positively associated with use ($p = .048$ for the contrast).

Discussion

In Ontario, 30% of those making a quit attempt used NRT. This is lower than that found in a study by Reid and Hammond[53] that showed that a fairly stable 50% of smokers making quit attempts over two years used medication. Our study is the first to consider which smokers should be using NRT, based on evidence-based guidelines for NRT effectiveness. Of the 27% of smokers who met guidelines for use in our analysis, just under 25% used NRT. This leaves roughly 20% of all Ontario smokers as, arguably, an "ideal" but unreached target population.

Despite the importance of quantitative data on the reach of public health interventions,[18] few reports have estimated population prevalence of NRT in specific time periods. Population health surveys often lack the precision to quantify NRT conditional on smoking and quit attempts. In 1990, in a sample of Minnesotans with access to NRT through insurance plans with co-payment,[54] roughly half of those trying to quit used aids, primarily pharmacotherapy; in California between 1999 and 2002, 17% of all smokers used pharmacotherapy in the past year.[55] In the U.S. in 2003, 32% reported a quit attempt in the past year using medication,[56] whereas in 2010, 30% of all smokers used medication in the past year.[57] In the United

TABLE 2 (continued)
Characteristics of a population-representative cohort of adult smokers who reported using NRT products "to quit or cut down" in a six-month follow-up period, Ontario, Canada

Characteristics of smokers (*n* = 301)		Weighted, %	95% confidence interval
Stop-smoking medications make it easier to quit than trying to quit on your own			
	Agree	83.9	78.5–89.3
	Disagree	14.8	9.5–20.1
	Don't know	1.4	0.4–2.4
The cost of stop-smoking medications makes it difficult to use them			
	Agree	58.2	50.5–65.9
	Disagree	40.2	32.5–47.9
	Don't know	1.6	0.3–3.0
Stop-smoking medications are hard to get	Agree	9.5	5.3–13.7
	Disagree	87.6	82.9–92.2
	Don't know	3.0	0.7–5.3
The risk of side effects from stop-smoking medications concerns you			
	Agree	51.5	43.8–59.2
	Disagree	47.8	40.1–55.5
	Don't know	0.7	0.0–1.4
Combination of indications for NRT use			
Intention or attempts to quit plus 10+ cigarettes/day			
	Yes	58.6	50.7–66.4
	No	41.4	33.6–49.3
Intention or attempts to quit plus 10+ cigarettes/day plus any support			
	Yes	37.3	29.8–44.7
	No	62.7	55.3–70.2
Intention or attempts to quit plus any support	Yes	55.0	47.3–62.7
	No	45.0	37.3–52.7

Source: Ontario Tobacco Survey, Ontario Tobacco Research Unit, July 2005 to December 2007 (Cohorts 1 to 4 with six-month follow-up data).

Abbreviation: NRT, nicotine replacement therapy.

[a] Cell size less than 5; estimates have been suppressed to maintain confidentiality.

Kingdom, where NRT is publically funded through the National Health Service, roughly half of smokers used it in recent quit attempts.[12]

Not all smokers feel medications are necessary,[13,14,58] and many quit on their own.[56,59] However, Ontario utilization rates may not reflect lack of interest; in 2006, a provincial NRT giveaway attracted 16 000 people in six weeks.[60] We found no difference in use by education, as anticipated and seen in American data;[57] however, we did not have access to more direct measures of insurance or ability to pay.[60]

Earlier studies showed that ever users of NRT tend to be more dependent or smoke more cigarettes.[7,45,54,61–63] In our study, number of cigarettes smoked did not predict NRT use, which contrasts with several retrospective studies;[7,54] however, cigarette consumption was associated with NRT use among smokers trying to quit, as elsewhere.[12] Among all smokers, lower consumption may follow from efforts to cut down.[64] American guidelines on NRT cite a minimum number of cigarettes primarily because of a lack of clinical trials data for people who smoke less.[1–3] Australian practice guidelines, in contrast, state that NRT should be offered with evidence of dependence.[65] We found that over 90% of respondents who smoked fewer than 10 cigarettes at baseline and who used NRT perceived themselves to be very or somewhat addicted.

Intending or actually trying to quit were significantly associated with NRT use, which was consistent with findings from California.[63] Just 3% of Ontarians who neither intended nor tried to quit used NRT. This does not suggest widespread use of NRT with no intention to quit, as has been suggested as a negative consequence of NRT availability.[34–38,66,67] However, we asked about NRT use "to quit or reduce smoking" (to exclude use of services for a different health reason) and may not have captured all NRT use, for example, by people who planned only to reduce, but not discontinue, smoking. Intention to quit may also change or be unreliably measured.[68] We addressed this by considering intention with and without subsequent attempts to quit.

In our study, smokers who received non-pharmaceutical support were more likely to use NRT, whereas previous studies report mixed findings. NRT users rarely used behavioural supports in Minnesota,[54] whereas in California[7] and Australia[62] NRT users were more likely to use behavioural supports. Ontario data may reflect consistency of advice from professionals and packaging to use behavioural supports. However, as in most studies,[69] we have no information on the intensity or quality of the supports received. Our study, like others,[45,61] found that past use of NRT was associated with prospective use, but some use may have started before the baseline interview and continued into follow-up. Not surprisingly, smokers with positive attitudes towards NRT were more likely to use these medications.[62,70–72]

Our analysis used data to 2008, after which time NRT manufacturers were permitted to advertise NRT for use while cutting down to quit. Future studies should ask about NRT for use only to cut down or only when one cannot smoke.[63,66,67,73] Our study will provide baseline data to evaluate the impact of these changes and recent initiatives to publicly fund NRT.

Conclusion

Widely available NRT is a recommended population-based measure to reduce tobacco-related health burden. In this population, where NRT was available over

TABLE 3
Results of multiple log-binomial regression models predicting NRT use, in six-month follow-up, for all smokers and for those who attempted to quit over the same six-month period

Characteristic	Predicting 6-month prevalent use of NRT in all smokers (N = 2011)		Predicting NRT use among those who made a quit attempt in 6-month follow-up (N = 439)	
	PR (95% CI)	*p* value	PR (95% CI)	*p* value
Age (continuous, per 10 years of age)	0.94 (0.84–1.05)	.250	1.01 (0.90–1.14)	.853
Sex				
Female (reference)	1.00		1.00	
Male	0.86 (0.65–1.15)	.319	0.73 (0.53–1.02)	.065
Education				
High school or less (reference)	1.00		1.00	
More than high school	1.09 (0.80–1.47)	.582	1.27 (0.89–1.81)	.183
Consumption (continuous, cigarettes/day)	1.01 (0.99–1.03)	.226	1.02 (1.00–1.04)	.025
Time from waking to first cigarette, minutes				
< 30	0.90 (0.65–1.24)	.516	0.69 (0.47–1.00)	.051
> 30 (reference)	1.00		1.00	
Previous number of quit attempts at baseline				
> 1	0.69 (0.40–1.22)	.201	0.49 (0.27–0.88)	.017
0 (reference)	1.00		1.00	
History of NRT use at baseline				
Yes, > 1 times	3.04 (2.04–4.54)	< .001	2.68 (1.69–4.26)	< .001
No (reference)	1.00		1.00	
History of behavioural support at baseline[a]				
Yes, > 1 times	1.35 (1.02–1.79)	.038	1.40 (1.06–1.87)	.020
No (reference)	1.00		1.00	
Baseline intention to quit in 6 months				.042
Yes	–	–	0.68 (0.47–0.99)	
No (reference)			1.00	
Made a serious attempt to quit smoking during 6-month follow-up period				
Yes	6.76 (4.72–9.69)	< .001		
No (reference)	1.00		–	–
Use of any behavioural supports during follow-up				
Yes	1.53 (1.11–2.11)	.009	1.15 (0.82–1.63)	.418
No (reference)	1.00		1.00	
Confidence in ability to quit				
Very confident	0.78 (0.44–1.39)	.403	0.90 (0.48–1.70)	.751
Fairly confident	1.14 (0.68–1.93)	.611	1.30 (0.75–2.24)	.345
Not very confident	1.16 (0.68–1.98)	.584	1.36 (0.78–2.39)	.278
Not at all confident (reference)	1.00		1.00	
Stop-smoking medications make it easier to quit than trying to quit on your own[a]				
Disagree	0.71 (0.44–1.13)	.150	0.76 (0.43–1.33)	.334
Don't know	0.62 (0.26–1.47)	.276	0.57 (0.23–1.41)	.221
Agree (reference)	1.00		1.00	
The cost of stop-smoking medications makes it difficult to use them				
Disagree	1.04 (0.79–1.39)	.768	1.09 (0.80–1.50)	.579
Don't know	0.27 (0.08–0.97)	.045	0.09 (0.02–0.58)	.011
Agree (reference)	1.00		1.00	

Continued on the following page

TABLE 3 (continued)
Results of multiple log-binomial regression models predicting NRT use, in six-month follow-up, for all smokers and for those who attempted to quit over the same six-month period

Characteristic	Predicting 6-month prevalent use of NRT in all smokers (N – 2031)		Predicting NRT use among those who made a quit attempt in 6-month follow-up (N – 439)	
	PR (95% CI)	*p* value	PR (95% CI)	*p* value
Stop-smoking medications are hard to get				
Disagree	1.32 (0.78–2.25)	.296	1.18 (0.66–2.13)	.574
Don't know	1.98 (0.86–4.59)	.110	2.72 (1.01–7.34)	.048
Agree (reference)	1.00		1.00	
The risk of side effects from stop-smoking medications concerns you				
Disagree	1.13 (0.85–1.50)	.413	1.25 (0.90–1.73)	.181
Don't know	0.26 (0.06–1.14)	.073	[excluded][b]	
Agree (reference)	1.00		1.00	

Abbreviations: CI, confidence interval; NRT, nicotine replacement therapy; PR, prevalence ratio.

[a] Behavioural support considered as either advice from a physician or other forms.

[b] Excludes fewer than 5 observations who said "Don't know."

the counter and use of supplemental behavioural supports advocated, most smokers trying to quit were not using NRT. Approximately 20% of Ontario smokers were an "ideal" but unreached target population for NRT use. Ontario has recently implemented new initiatives to increase the accessibility of NRT. As such, further surveillance and research are warranted to determine the impact of the reach and benefits of NRT, considering both the general and targeted smoking populations.

Acknowledgements

Support for this research was provided by the Ontario Tobacco Research Unit, which receives funding from the Ontario Ministry of Health Promotion and Sport, and the University of Toronto Dalla Lana School of Public Health.

The authors have no conflicts of interest. None of the authors work or have worked in any capacity with, or received remuneration from, the manufacturers or sellers of tobacco products or nicotine replacement therapy products. The lead author was an investigator on The Stop Smoking for Ontario Patients study funded by the Ontario Ministry of Health and Long-Term Care and which received support in kind from manufacturers of nicotine replacement therapy products without intellectual restriction.

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Utilization of the Canadian Incidence Study of Reported Child Abuse and Neglect by child welfare agencies in Ontario

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This article has been peer reviewed.

Abstract

Introduction: The purpose of this study was to analyze how child maltreatment surveillance data from the Canadian Incidence Study of Reported Child Abuse and Neglect (CIS) is used by senior child welfare decision makers.

Methods: This triangulation mixed-methods study included quantitative and qualitative methods to facilitate an in-depth exploration from multiple perspectives. We interviewed Ontario child welfare decision makers to measure utilization of the CIS in policy development.

Results: The majority of respondents were aware of the CIS data. Decision makers reported using these data to determine resource allocation, understand reported maltreatment trends and validate findings at their own agencies. Urban agencies used the data more than did rural agencies.

Conclusion: This study is the first to triangulate data to understand and improve utilization of child maltreatment surveillance data. The study participants indicated considerable appreciation of the data and also provided ideas for improvements across the surveillance cycle.

Keywords: child maltreatment, surveillance, Canadian Incidence Study of Reported Child Abuse and Neglect, data utilization, policy development

Introduction

The Canadian Incidence Study of Reported Child Abuse and Neglect (CIS) is one of the Public Health Agency of Canada's (PHAC) national health surveillance programs. Since 1998, data have been collected from child welfare agencies every five years. The CIS captures data on child maltreatment (exposure to intimate partner violence, neglect, emotional maltreatment, physical and sexual abuse), the extent of its harm, the source of the allegation, short-term investigation outcomes, child and family characteristics and functioning issues.[1] The CIS captures information at the national level, but some provinces and territories collect additional data to obtain estimates specific to their jurisdiction. For example, provincial data in Ontario have been collected through the Ontario Incidence Study of Reported Child Abuse and Neglect (OIS), the antecedent of the CIS, since 1993.

Surveillance data are collected to support decision makers in setting priorities and allocating resources in policy development. The data should be able to identify at-risk populations, monitor trends, detect emerging issues and notice changes in professional practice.[2] The components of the surveillance cycle are the collection, analyses, interpretation and dissemination of data. Feedback is then solicited from the field to improve subsequent cycles. CIS data have been analyzed to produce surveillance reports, articles, book chapters and fact sheets. These publications illustrate how CIS surveillance data inform child welfare practice and policy, for example, by providing educational material about child welfare to students in high schools, universities and continuing education programs;[3] supporting the implementation of differential response in some jurisdictions;[3] contributing to the United Nations' understanding of child neglect;[4] requesting augmented funding[5] and enhancing maltreatment prevention by First Nations agencies. However, no CIS surveillance evaluation on aspects such as flexibility, system accessibility and stability has been published to date.

Provincial and local child welfare decision makers are a target audience for the CIS findings. They can influence and adapt programs, policies and practices by responding to emerging trends and issues highlighted by surveillance data. While there is an emerging field of science within child welfare focused on evidence-informed decision-making[6] and the importance of integrating research evidence into practice and policy,[7] no attention has been paid to exploring how decision makers perceive and use surveillance data, a very specific form of research evidence. We identified only one study from First

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Nations agencies regarding the utility of surveillance data.[8] However, no clear conclusions could be drawn due to the small sample size. The authors speculated that the remoteness of the locations impeded opportunities for decision makers to foster networks with researchers and/or participate in conferences and meetings. Challenges in accessing evidence are an identified barrier to utilizing child-welfare research in Australia, Ireland and Ontario.[9–11] A Quebec study showed that relative position within an organization mattered in terms of research utilization.[12]

This analysis is a component of a larger mixed-methods study.[11] Our study focuses on Ontario child welfare decision makers' perceptions and use of the results from the CIS/OIS. We define utilization of research, and specifically surveillance data, as the transfer and uptake of research-based knowledge into policy and practice. The objectives of this paper are to:

- examine Ontario child-welfare agency decision makers' awareness and perceptions of the CIS;
- describe the CIS dissemination methods that decision makers prefer;
- explore how the CIS is utilized for child welfare policy and practice in Ontario; and
- identify strategies for improving aspects of the surveillance cycle (data collection, data analysis, dissemination and feedback from the field).

Methods

This mixed methods study included both quantitative and qualitative methods to facilitate in-depth research from a number of perspectives.[13] We administered a quantitative survey to senior Ontario child-welfare decision makers to measure research utilization in policy development. This component covered the first and third objectives of our study (awareness/perceptions of the CIS; preferred CIS dissemination methods). The qualitative component of this analysis used case-study methodology[14] to explore *how* child-welfare decision makers used the CIS/OIS public health surveillance data and to identify *what* influence and impact surveillance findings have had on child-welfare policy. The qualitative study covered all four objectives.

Only the three most senior decision makers in each agency (executive directors, services directors and supervisors/managers/other positions) were eligible to participate in both the quantitative and qualitative components.

The Hamilton Health Sciences/McMaster Faculty of Health Sciences Research Ethics Board and the Ontario Association of Children's Aid Societies (OACAS) reviewed and approved the project.

Qualitative case study

We used an embedded, multiple-case approach[14] to guide this case study of child-welfare agencies delivering services to populations in urban centres, mixed rural/small urban centres, or remote communities. It was determined that we would reach theme saturation by selecting 13 agencies that provided services to geographically or culturally unique populations. Nine consented to participate and four declined due to time constraints. From each of these nine participating agencies, the three most senior decision makers were invited to participate in two semi-structured, in-depth qualitative interviews. We conducted 21 interviews in-person and six by telephone (due to schedule conflicts or remote location of agencies) between March and September 2007. The focus of the first interview, lasting 60 to 90 minutes, was to explore the individual, organizational and system-level influences on the interviewees' ability to utilize research evidence in decision-making. We also asked about their awareness and utilization of CIS/OIS data (questionnaire available upon request). Six to nine months after this initial interview, we conducted telephone interviews (n = 19) lasting on average 45 minutes. This interview allowed us to verify our interpretation of the data and confirmed the validity of concepts that arose throughout all the interviews. The remaining 8 participants did not complete a second interview either because they had left the agency or because they could not be contacted despite numerous attempts.

All participants completed a demographic questionnaire. We kept field notes on topics, observations and researchers' responses to events.[15]

Qualitative data analysis

We conducted the data analysis and collection concurrently to identify themes requiring further exploration. Content analysis principles guided the examination of each transcript. Two investigators independently reviewed and coded each transcript. This double-coding and peer examination promoted consistency of emerging qualitative findings. Once the core themes from each interview were identified, we used a constant comparative process[15] to contrast findings across contexts and identify research utilization concepts and factors influencing the research uptake process.

Quantitative data

In the second phase of the study, aiming for a census we contacted all 53 child-welfare agencies in Ontario to participate in the study. Of these, 41 agreed to participate (77% participation rate). Of the 123 eligible senior decision makers from the participating agencies, we interviewed 98 (80% participation rate) using a questionnaire developed for decision makers in public health.[16,17] We added questions about the CIS/OIS to this tool, totalling 53 questions and lasting 30 to 45 minutes. One researcher conducted telephone interviews (between December 2007 and September 2008) and completed each questionnaire using a customized module in Microsoft Access 2007 (Redmond, WA, United States).

Quantitative data analysis

We performed the statistical analyses in two stages. First, we analyzed univariate and bivariate relationships. We conducted a significance test (Fisher exact test) for each variable by the respondent's position and gender and the agency's location. Next, we ran a linear regression to model participants' satisfaction with the CIS/OIS.

Correlates were selected from the variables described in Table 1 using a backward selection approach ($\alpha = .10$). Due to the similarities between CIS and OIS findings, we only report information about the CIS. We used PROC FREQ and PROC GLM in SAS/STAT® software, version 9.1 for Windows (SAS Institute Inc., Cary, NC) for the analyses.

Sample characteristics

Table 2 describes the demographics for both parts of the study. For the quantitative phase, 84 of the respondents worked in an urban/mixed agency and 14 in a rural agency. Of the respondents, 55 were women and 43 were men; 36 were executive directors; 32 were service directors; and 30 worked as supervisors/managers or in other positions.

About half (55%) of the agencies in the sample had a formal university affiliation. Almost 85% of the respondents held a graduate degree and had extensive experience in child welfare.

Results

The following qualitative results correspond to all four study objectives and the quantitative results to the first and third objectives.

Qualitative results

Awareness and perception of the CIS

The majority of respondents (84%) were aware of the CIS, having learned about it through, for example, the distribution of reports, participation in meetings or conferences, postings of CIS findings (e.g. by the OACAS or the Child Welfare League of Canada), and presentations and involvement in the data collection by the agency. Most respondents acknowledged that the report was circulated among senior decision makers within the agency but did not always reach the front-line workers.

TABLE 1
Description of the CIS/OIS questions/variables used in the quantitative survey

Variable	Measure
Organizational characteristics of agency	
Type	Children's Aid Society or First Nations Agency
Location	Urban/mixed[a] or rural
Individual characteristics	
Sex	Male or female
Current position	Executive director, director (services or quality assurance) or supervisor/manager/other
Education (highest degree achieved)	Secondary, post-secondary or other
Participant's perception of research evidence	
Direct supervisor expects the participant to use research evidence for planning	Likert scale: 1 (low) to 7 (high)
Research evidence is consistently included in program planning	Likert scale:1 (low) to 7 (high)
Relevance of research literature to the participant's work	Likert scale:1 (low) to 7 (high)
Participant's perception of the CIS/OIS	
Has ever seen the CIS	Yes/no
Has ever seen the OIS	Yes/no
Has used the CIS within past year to make policy/program decisions	Yes/no
Has used the OIS within past year to make policy/program decisions	Yes/no
Organization has made policy/program decisions related to child abuse and neglect in the past year	Yes/no
CIS relevance to the participant's field	Likert scale: 1 (low) to 7 (high)
CIS ease of use	Likert scale: 1 (low) to 7 (high)
OIS relevance to the participant's field	Likert scale: 1 (low) to 7 (high)
OIS ease of use	Likert scale: 1 (low) to 7 (high)
Extent to which CIS data was considered in the decision-making process in the past year	Likert scale: 1 (low) to 7 (high)
Extent to which CIS data influenced that decision	Likert scale: 1 (low) to 7 (high)
Extent to which incorporating CIS data in the decision-making process leads to concrete changes in policies/programs	Likert scale: 1 (low) to 7 (high)
Extent to which incorporating CIS data in the decision-making process confirmed current policies/programs related to the decision	Likert scale: 1 (low) to 7 (high)
The participant's general satisfaction with CIS	Likert scale: 1 (low) to 7 (high)

Abbreviations: CIS, Canadian Incidence Study of Reported Child Abuse and Neglect; OIS, Ontario Incidence Study of Reported Child Abuse and Neglect.

[a] Urban and mixed locations were collapsed due to the small number of respondents and empirical similarities.

TABLE 2
Characteristics of the respondents in the qualitative (initial interview) and quantitative surveys

Variable		Qualitative (initial interview) (n = 27)		Quantitative (n = 98)	
		n	%	n	%
Location	Urban/mixed	18	67	84	86
	Rural	9	33	14	14
Position	Executive Director	9	33	36	37
	Services Director	9	33	32	33
	Supervisor/manager/other positions	9	33	30	31
Experience	Average years in child welfare	19	70	21	21
	Average years in current agency[a]	14	52	—	—
	Average years in current position	7	26	7	7
Education	Bachelor's degree	4	15	6	6
	Master's degree or higher	20	74	85	87
	College/diploma/other	3	11	7	7
Sex	Female	18	67	55	56
	Male	9	33	43	44
Total		27		98	

[a] Not asked in quantitative survey.

Decision makers from urban/mixed sites were knowledgeable about the content of the CIS and could identify examples of data collected. Those from rural agencies, with the exception of respondents who had participated in CIS data collection, were not familiar with the CIS. One rural respondent identified how their agency's participation in the CIS fostered an investment in the findings:

> [...] we were one of the first rural participators... So we've paid attention to the outcome of that research because we see it personally, we're engaged in it, so it was important for us to review and think about the outcomes of that.

Description of preferred CIS dissemination methods

Respondents emphasized the importance of the CIS using many different ways to disseminate information and the value of frequent communication. They confirmed that surveillance reports should be available in hard and electronic formats. In addition, they considered essential the inclusion of interpretations of findings in report summaries because they were too busy to read lengthy reports. The majority disclosed that they primarily read the executive summary and/or fact sheets and used the full report only to obtain further information on specific topics. Respondents also stressed the value of face-to-face presentations to agency staff by someone knowledgeable about CIS findings, especially in rural agencies. One respondent said:

> The information was right there, it was visual, and they were talking to people who live this everyday. And so there was time left in the presentation for a discussion—why do you think that would be, does that resonate with you guys or not, does it seem like it's right off the wall? And there was lots of time for conversation and for exchange of ideas and really kind of connecting with the information.

Respondents reflected positively on discussions with and presentations by CIS researchers and agency staff who were knowledgeable about CIS and could interpret the data. They saw it as an opportunity to increase learning and engagement with the data.

An additional theme emerged around the frequency with which CIS reports were disseminated. The respondents preferred receiving data more frequently than the present rate of every five years, current data being most relevant to policy development. Decision makers are regularly required to prioritize where to invest their limited resources; thus up-to-date information on current and emerging trends (such as the decline in substantiated sexual abuse) is perceived as helpful. Some respondents mentioned advantages to regularly receiving "short CIS summaries" via portals frequently accessed by staff. One respondent suggested:

> I think people don't have time to read anymore. Here's a great idea, do like a one liner like every week... Send me a highlight from this posted on OACAS, wherever... So in the weekly news I can say ok this is the finding I saw this week. So it's that constant messaging, changing it up every time so you are not saying the same thing...

Other suggestions included having fact sheets and summaries with embedded links to background documents or related research. Yet another idea was to link CIS results to practical interventions in order to demonstrate a concrete utility of findings.

Utilization of the CIS

Many of the decision makers acknowledged that the CIS data, presented at a national level, provided the "big picture" and was very relevant for provincial policy development. At the agency level, decision makers found the CIS data most useful in (1) identifying emerging child maltreatment trends so that agency policies or programs could be adjusted; (2) providing a benchmark for their local statistics and insights into issues; and (3) confirming local observations and hypotheses about child maltreatment trends. For example, in 2005 the CIS confirmed an increase in reports of children exposed to intimate partner violence, a decline in reported sexual abuse and that neglect is common.[1] These data influenced some organizations to re-examine their resource allocation to families exposed to intimate partner violence or to restructure their sexual abuse prevention and

treatment programs. As one decision maker explained:

> I think [the CIS is] a very good effort to iron out those wrinkles and to give the people who are making policy and who are doing the work related to this phenomenon information about trends and incidence so the amount of different kinds of abuse and the nature of that abuse and how it's changing over time, and some of the implications of that. One of the strongest ones I think you know—there's upswings in physical abuse and downswings in sexual abuse over the years and we're always challenged to figure out why exactly those things are happening, whether it's because we're being more effective, less effective, whatever.

Some respondents mentioned that the CIS informed their policies indirectly by creating knowledge that could influence day-to-day decision-making. Others were less optimistic about their ability to influence policy and claimed that policy changes only happen through the provincial Ministry of Children and Youth Services. Rural participants were the least convinced that the findings did—or would—impact their agencies' policy making.

Improving various aspects of the surveillance cycle

Participants from the qualitative phase provided insights into areas where the CIS could be improved. The majority of the respondents felt that the surveillance report was comprehensive and required no changes. Some others suggested that further data could be collected and analyzed to be predictive of future trends, rather than just reporting incidence. Yet others suggested that the results needed to be interpreted and contextualized in terms of Ministry mandates. Some rural respondents sought agency staff involvement in developing the CIS questionnaire to ensure that the information was relevant. Others suggested using longitudinal data collection and linkages to existing data sources such as *Looking after Children*.* Respondents also asked if the CIS could find a way to track the outcomes of investigations and to determine the effectiveness of child welfare interventions. Others proposed providing provincial comparators or demographic characteristics, such as immigration/citizenship status, race and gender. Comparisons of the findings to the community child population were also requested as well as the collection and analysis of Aboriginal data.

One of the barriers to using CIS findings was that it differs from data collection for planning mandated by the Ministry of Children and Youth Services. Definitions and content used in the CIS differ from Ministry systems, which impedes comparison. For instance, while agencies count the final decision for short- and long-term placements regardless of maltreatment type, the CIS captures short-term placements and reason for the investigation.

Respondents provided suggestions for specific analyses of the data, such as detailed information about types of maltreatment in general, and neglect and exposure to intimate partner violence specifically, considering their high prevalence in the CIS and their co-occurrence with other maltreatment. They also requested data about the effectiveness of placement, in particular, kinship. Other areas for exploration included the relationship between poverty and the need for child welfare intervention, and parents' and children's mental health and/or addictions.

Quantitative findings

Awareness/perception and utilization of the CIS

Overall, 96% of respondents were aware of the CIS. We found significant differences between urban/mixed and rural agencies on awareness of the CIS, relevance of the research literature to the participant's work, as well as ease of use of CIS data and general satisfaction (Table 3). However, differences by position and gender were not significant in our analysis and therefore are not shown.

Figure 1 shows the distribution of overall satisfaction with the CIS data and the difference between urban/mixed and rural agencies. On a scale of 1 to 7, the most common score was 6 in all types of agencies. However, rural agencies had more response variability.

Table 4 shows the regression results for individual and agency characteristics that are associated with satisfaction with and relevance of the CIS. Respondents who gave a higher score to the relevance of research literature to their work also gave a higher score to the relevance of the CIS. The CIS relevance score was lower for rural agencies. Overall CIS satisfaction was associated with CIS ease of use and urban/mixed location. Rural agencies scored CIS satisfaction lower than did urban/mixed agencies.

Discussion

The results of our study show that the majority of respondents were aware of the CIS. Study findings reached them through websites, conferences and researchers' visits to the agencies. Not surprisingly, those agencies that participated in data collection and/or attended researchers' presentations had a better grasp of CIS content. CIS data were considered useful although respondents had suggestions for improvements. Our data suggested that respondents from urban/mixed locations are more knowledgeable about the CIS than those from rural areas. Cost is a prohibitive factor in data collection from rural agencies as is the ability to present them with research findings individually.

Among the interviewed decision makers, the CIS met its surveillance objectives in that respondents confirmed its utility in identifying at-risk populations, monitoring trends, detecting emerging issues and directing changes in practice. The respondents mentioned that it was especially useful to monitor maltreatment trends and confirm their local observations. It seems counterintuitive that while respondents were generally satisfied with the CIS and considered it highly relevant, only a minority used CIS data in decision-making. One possible explanation is that our data collection tools did not successfully

* http://www.cwlc.ca/projects/canlac

TABLE 3
Descriptive statistics from the quantitative survey

Total Respondents (N = 98)	Urban/mixed (n = 84) Responded[a], %	Median	Rural (n = 14) Responded[a], %	Median	*p* value[b]
Dichotomous response					
Has ever seen the CIS					
Yes	98	—	86	—	< .05
No	2	—	14	—	
Missing/not applicable	0	—	0	—	
Has ever seen the OIS					
Yes	95	—	86	—	
No	2	—	0	—	
Missing/not applicable	2	—	14	—	
Has used the CIS within last year to make policy/program decisions					
Yes	33	—	14	—	
No	62	—	71	—	
Missing/not applicable	5	—	14	—	
Has used the OIS within last year to make policy/program decisions					
Yes	40	—	21	—	
No	55	—	64	—	
Missing/not applicable	5	—	14	—	
Organization has made policy/program decisions related to child abuse and neglect in the past year					
Yes	98	—	86	—	
No	1	—	14	—	
Missing	1	—	0	—	
Likert scale[c]					
Direct supervisor expects the participant to use research evidence for planning	95	5.00	93	4.00	< .001
Research evidence is consistently included in program planning	99	4.00	100	4.00	
Relevance of research literature to the participant's work	99	6.00	100	5.00	< .05
CIS relevance to the participant's field	93	6.00	64	5.00	< .05
CIS ease of use	87	6.00	57	4.50	< .05
OIS relevance to the participant's field	90	7.00	64	6.00	
OIS ease of use	85	6.00	57	4.50	< .01
Extent to which CIS data was considered in the decision-making process in the past year	85	2.00	79	1.00	
Extent to which CIS data influenced that decision	83	2.00	79	1.00	
Extent to which the incorporation of CIS data in the decision-making process lead to concrete changes in policies/programs	81	1.00	93	1.00	
Extent to which the incorporation of CIS data in the decision-making process confirmed current policies/programs related to the decision	81	1.00	93	1.00	
The participant's general satisfaction with CIS	87	6.00	57	5.00	< .05

Table continued, see right column

capture direct use at the agency level. It is also possible that the CIS may be more useful at the Ministerial level.

It is notable that many of the critiques and suggested changes are outside the scope of CIS surveillance. This indicates that some respondents do not recognise the goal and limitations of surveillance data. For instance, the CIS is designed to inform development of interventions through risk factor identification, but this is not intervention data per se. It is important that the scope of surveillance data be clarified for users. The additional data requested by respondents (i.e. demographics) already exist in the CIS program (except immigration status), which suggests these respondents were unfamiliar with the CIS. Many suggestions to expand the CIS scope were likely derived from the paucity of Canadian child maltreatment data. The CIS has provided an important platform to promote further data collection efforts. However, there is a need to expand research within child welfare.

Many of the gaps identified by respondents are being addressed by PHAC and its partners. For example, respondents in various agencies mentioned the need for more data on Aboriginal people. Aboriginal agency participation has increased with each cycle,[18] and several analyses have focused on Aboriginal children and their families.[19-22] Also, the CIS has started to be used in conjunction with other data sets to obtain a more complete depiction of child maltreatment. For instance, one researcher investigated the reported decline in substantiated sexual abuse comparing CIS and Quebec data.[23]

Also promising is that analyses have been conducted on several of the issues suggested by the respondents, for example, youth substance abuse,[24] anxiety/depression in adolescents,[25] neglect[26] and exposure to domestic violence.[27] In a recent

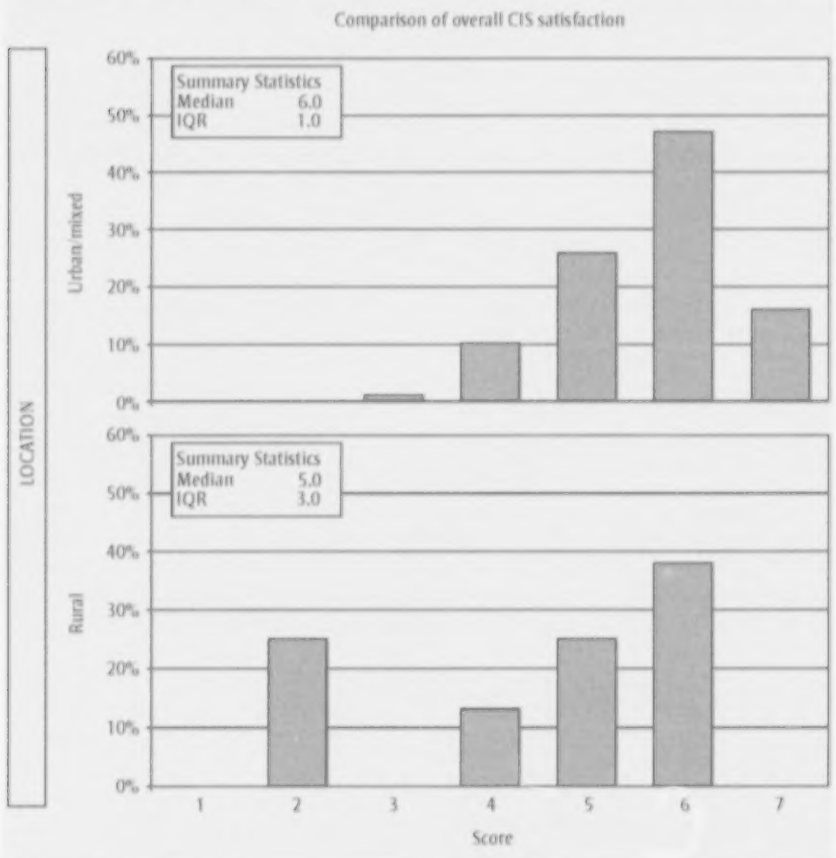
Abbreviations: CIS, Canadian Incidence Study of Reported Child Abuse and Neglect; OIS, Ontario Incidence Study of Reported Child Abuse and Neglect.

[a] May not add to 100% due to rounding.

[b] Fisher exact test.

[c] The Likert scale ranges from 1 (low) to 7 (high).

FIGURE 1
Distribution of the overall satisfaction with the Canadian Incidence Study of Reported Child Abuse and Neglect (CIS) by location of respondents of the quantitative survey



Abbreviation: IQR, interquartile range.

TABLE 4
Results of multivariate analyses on the Canadian Incidence Study of Reported Child Abuse and Neglect (CIS) perception and satisfaction

Model Dependent variable	Covariates	B	se (B)	t	p
CIS relevance[a]	Intercept	4.14	0.70	5.95	< .01
	Location (rural)	−0.86	0.44	−1.95	.05
	Relevance of research literature to participant's work[b]	0.31	0.12	2.69	< .01
Overall satisfaction with the CIS[c]					
	Intercept	3.17	0.57	5.54	< .01
	Location (rural)	−0.70	0.34	−2.06	.04
	Child welfare experience (years)	0.02	0.01	1.94	.05
	CIS ease of use[b]	0.36	0.09	4.01	< .01

Abbreviations: CIS, Canadian Incidence Study of Reported Child Abuse and Neglect; CV, coefficient of variation.

[a] Model diagnostics: $R^2 = 0.14$; CV = 21.02; $p < .01$.

[b] The score for this variable ranges from 1 (low) to 7 (high).

[c] Model diagnostics: $R^2 = 0.33$; CV = 15.42; $p < .01$

review of the CIS, the authors identified 37 manuscripts based on original analyses published in peer-reviewed journals.[28] However, several issues remain unanalyzed, and a process needs to be developed to inform decision makers about existing CIS analyses.

Interview respondents identified conferences as dissemination channels for CIS findings; however, earlier research has questioned the effectiveness of these for health care professionals.[29] Possibly conferences are viewed more positively by those working in child welfare than in health care. Other dissemination methods such as websites and presentations at the agencies were also mentioned. Rural agencies valued in-person presentations more than did urban/mixed agencies. The respondents felt that on-site presentations created an opportunity to clarify findings and allowed all staff members, not just management, to be present. We cannot say which means of dissemination were the most effective as participants were not asked to rank information sources.

Dissemination plans have been developed for each CIS cycle.[30] These plans have stressed the importance of developing multiple strategies for different audiences and targeting products specifically for these audiences. The next dissemination plan should incorporate key findings from this study. The respondents valued fact sheets, but they also found that the surveillance reports were an important resource. The utility would increase for them if the CIS were indexed. They also concluded that both hard and electronic copies of CIS-related materials were useful.

Collaboration is important in improving research use in decision making.[31] This idea has been emphasized since the CIS inception. For this, PHAC has established committees with representatives from the various Canadian Ministries. PHAC has also hosted several fora for the exchange of ideas about improvements to the CIS.[32,33] The findings from our regression models are not surprising. Estabrooks et al.[34] showed that predicting research utilization based on education had mixed results. Among professionals, those in managerial/leadership roles in health care

fields similar to the child welfare field consistently demonstrated more research utilization.[12,34] Our findings of the under-utilization of research are consistent with the child welfare literature; lack of access to the research has been suggested as an explanation.[8–11] Gender and age are included as control variables in many studies; however, they were not significant in this study, and thus were not included in our models. Additionally, since these variables are not modifiable, the focus has been on other individual characteristics.

Implications

Although some suggestions for improvements have been addressed, there are others to consider. Several respondents felt that the CIS needed to be conducted more frequently to increase utility. A cost-benefit analysis needs to be conducted; service data have a shorter shelf-life than population-based data, since changes in practice influence what constitutes maltreatment. For instance, expansion of reporting laws to include exposure to intimate partner violence in Minnesota created an influx of new cases.[35] Other respondents asked for longitudinal data, to better understand children's situation when placed outside the home. Intervention data were also requested. Surveillance systems should be flexible to meet the needs of the users so the feasibility of including other requested information in the CIS needs to be explored. Most importantly, disseminating efforts should target rural areas.

Strengths and limitations

This study has many strong points: we used both qualitative and quantitative methods for data collection and analysis to promote overall data credibility; we used an embedded, multiple-case approach to guide the case study (three case studies were conducted at the same agency providing different perspectives); and we interviewed professionals at both urban/mixed and rural agencies across Ontario.

However, the findings should be interpreted within the limitations of the study. We do not know if these findings are generalizable outside Ontario. Moreover, the small sample size may have precluded the detection of differences in responses. We can only speculate how the results were influenced by attrition between the first and the second qualitative interview. The 19 who participated in the second interview agreed that the research team had accurately interpreted the experiences they had described in the first interview; however, it is impossible to predict if the eight who did not participate would have concurred.

Conclusion

The CIS, as part of Canada's child health surveillance program, provides valuable and important data on a highly vulnerable population who face risk factors with potential lifelong consequences. There is a growing recognition of the significance of these data in influencing practice, policy and program development at all levels. This triangulation study was the first to analyze the utilization of maltreatment surveillance data among decision makers. It identified a high appreciation of the CIS and provided ideas for improvements in all aspects of the surveillance cycle.

Acknowledgements

We would like to thank the research project participants from Ontario child welfare agencies who shared their time, knowledge and expertise with the members of the study team. We appreciate the warm welcome that we received at each participating agency.

This study was funded through the Ontario Centre of Excellence for Child and Youth Mental Health at the Children's Hospital of Eastern Ontario. We also want to extend our thanks to Jasminka Draca, Pascal Roberge, Dr. Anne-Marie Ugnat and Dr. Catherine McCourt at the Public Health Agency of Canada and Karen Levine for their support.

Dr. Susan Jack is supported through the Institute of Human Development, Child and Youth Health, Reproduction and Child Health New Investigator Personnel Award from the Canadian Institutes of Health Research.

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Emergency department surveillance of injuries associated with bunk beds: the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP), 1990–2009

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This article has been peer reviewed.

Abstract

Introduction: Due to space constraints, bunk beds are a common sleeping arrangement in many homes. The height and design of the structure can present a fall and strangulation hazard, especially for young children. The primary purpose of this study was to describe bunk bed-related injuries reported to the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP), 1990–2009.

Methods: CHIRPP is an injury and poisoning surveillance system operating in 11 pediatric and 4 general emergency departments across Canada. Records were extracted using CHIRPP product codes and narratives.

Results: Over the 20-year surveillance period, 6002 individuals presented to Canadian emergency departments for an injury associated with a bunk bed. Overall, the frequency of bunk bed-related injuries in CHIRPP has remained relatively stable with an average annual percent change of −1.2% (−1.8% to −0.5%). Over 90% of upper bunk-related injuries were due to falls and children 3–5 years of age were most frequently injured (471.2/100 000 CHIRPP cases).

Conclusion: Children with bunk bed-related injuries continue to present to Canadian emergency departments, many with significant injuries. Injury prevention efforts should focus on children under 6 years of age.

Keywords: injury prevention, injury surveillance, bunk bed injuries, CHIRPP, furniture-related injuries, product safety

Introduction

Unintentional injuries are the leading cause of death among Canadian children and youth,[1] and many of these are related to consumer products. Bunk beds have been identified as an injury hazard for over 30 years,[2,3] especially for young children. They are associated with more severe injuries than those associated with conventional beds,[4] the most obvious reason being their height. Other "hidden" hazards include guardrail openings of specific dimensions that, given the anthropometry of some young children, could cause entrapment or strangulation. Some decorative components (e.g. the bedpost) can cause certain types of clothing to snag, and coupled with the height, present another potential form of strangulation. Improper assembly, due to unclear instructions, missing parts or faulty components, may also be hazardous.[5,6]

Since 1987, the United States has seen 34 product recalls involving 84 manufacturers and over 1.5 million bunk beds.[7] Recent U.S. estimates for those aged 0 to 21 years indicate an annual average of 35 790 cases of non-fatal bunk bed-related injuries treated in emergency departments (42 per 100 000 population) and, during 1990–1999, 10 fatalities per year.[8]

Since 2007, there have been 4 product recalls involving 4 manufacturers and over 23 000 bunk beds[9] in Canada, the most recent of which were 2 joint recalls with the Consumer Product Safety Commission in the United States (May and September, 2011) involving 21 707 units.[10] Between 1983 and 2011, there were 7 deaths related to the use of bunk beds reported to Health Canada's Consumer Product Safety Directorate. Three of the deaths involved children under 3 years of age, the most recent in 2008.[11,12] There are currently no specific regulations for bunk beds. Health Canada recommends that bunk beds sold, advertised, imported or manufactured in Canada meet the safety requirements of the latest version of the ASTM F1427 Standard Consumer Safety Specification for Bunk Beds.[6,13] While a number of reports from other countries discuss non-fatal bunk bed-related injuries, including hospitalization rate estimates,[8,14–18] there is no comprehensive study of bunk bed-associated injuries in Canada. Further, ICD-10* coding in Canada does not allow identification of deaths or hospitalizations by type of bed, so specific rates are not readily available.

* *International Classification of Diseases, 10th Revision.*

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While the leading cause of bunk bed-related deaths is entrapment/strangulation and all recalls are related to entrapment or collapse,[5,6] most non-fatal injuries involving bunk beds are due to falls.[8]

The primary objective of our study was to describe the Canadian experience of the mechanisms and temporal trends associated with emergency department presentations for bunk bed-related injuries. A secondary purpose was to provide Canadian population-based estimates of the rate of hospitalizations for falls from bunk beds by using the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) to develop a scaling factor (based on the ratio of bunk bed injuries to all bed injuries) that can be applied to ICD-coded national hospitalization data.

Methods

Data source

CHIRPP is an injury and poisoning surveillance system presently operating in 11 pediatric and 4 general hospitals across Canada since 1990.[19,20] The CHIRPP system runs on an Oracle platform and currently contains over 2.2 million records. The information collected includes activity at the time of injury; activity leading to the injury; the direct cause of the injury; contributing factors; time and place of the injury event; the patients' age and sex; up to 3 injuries (body part and nature of injury); and the treatment received in the emergency department. Narrative fields provide information to further refine the coding and to identify rare events. Numerous validation programs have been developed to track data quality. Although only selected hospitals report to CHIRPP, previous research has shown that the data collected through the program represent general injury patterns among Canadian youth.[21] Previous investigations have reported on other methodological aspects of CHIRPP.[22, 26]

Data extraction, cleaning and analysis

We identified cases by searching the entire CHIRPP database (1990–2009, all ages; extraction date: May 5, 2011) for injuries associated with bunk beds (CHIRPP product code 213). To ensure complete capture, we also searched narratives using variations of the following bilingual text strings: "BUNK BED," "LIT SUPER," "LIT A 2 ETAGES" and "LOFT BED." The CHIRPP narratives were used to code a mechanism variable that provided detailed information on the injury event beyond the basic numerical variables. This process is time-consuming for large datasets as the cases have to be reviewed individually. As a result, we used a subset of cases that had been previously coded as part of a student project. On comparing this subset (2002–2006) to the overall dataset, we found that it displayed a similar distribution on a number of key variables (age, sex, nature of injury and temporal variables). The full dataset (1990–2009) was therefore used only for the time-trend analysis.

Since CHIRPP is not population-based, data are usually presented in terms of proportions rather than strict counts. Age, sex and year data were normalized to the total numbers in the database using the following expression (presented as the number per 100 000 CHIRPP cases in the given year, age group or sex):

$$\textit{Normalized proportion} = \left(\frac{N_{BB}}{N_{CHIRPP}}\right) * 100{,}000$$

where N_{BB} is the number of bunk bed cases for the given age group, sex or year and N_{CHIRPP} is the total number of cases of all types in CHIRPP for the same age group, sex or year.

Year-to-year variations, likely due to small sample sizes, were smoothed by applying a three-point central moving average to the normalized proportions.[27] We examined trends in the normalized annual proportions in two ways. We estimated the average annual percentage change (AAPC) in the normalized proportion (with 95% confidence intervals [CIs]) by performing a regression of the natural logarithm of the normalized proportion on year. The slope of this regression line, β, was input into the following formula:[28,29]

$$\text{AAPC} = [e^{\beta} - 1] * 100$$

The data were also separated into 5-year time blocks and analyzed for period-to-period trends (X^2 test, $p < .05$). Other results are presented in conventional descriptive format.

Bunk bed hospitalization rate estimates

To meet the secondary objective of the study, CHIRPP was used as a data source to develop a scaling factor to be applied to national morbidity data. The scaling factor is a ratio that quantifies the proportion of bunk bed cases to all bed-related cases in CHIRPP. Hospitalization data[30] for the fiscal years 2003/2004 to 2008/2009, where the external cause of injury was "fall involving a bed" (ICD-10 code W06), were obtained from the Hospital Morbidity Database (HMDB) for 2003/2004 to 2005/2006 and the Discharge Abstract Database (DAD) for 2006/2007 to 2008/2009 (excluding Quebec). The hospital separation databases (HMDB and DAD) are managed by the Canadian Institute for Health Information (CIHI). The decision to start the analysis at 2003/2004 was due to the complex staggered transition from ICD-9[†] to ICD-10 prior to that. CHIRPP data were arranged into the same fiscal year ranges and stratified by age group (0–4, 5–9, 10–14, 0–14 years) and type of bed. For ages 0 to 4 years, cribs, conventional beds and bunk bed counts were identified and for ages 5 and older, conventional beds and bunk beds were identified. A CHIRPP scaling factor (F_{CHIRPP}) was developed for each age group based on the ratio of bunk beds to all beds (including cribs for 0–4 year olds). The estimate for the rate of hospitalizations due to falls from bunk beds ($\hat{R}_{BB}$) was calculated (for each age group) using the following equation:

$$\hat{R}_{BB} = \left(\frac{F_{CHIRPP} * n_{W06}}{N_{age}}\right) * 100\,000,$$

where

$$F_{CHIRPP} = \left(\frac{n_{BB}}{N_B}\right),$$

n_{W06} is the number of cases of hospitalization (HMDB/DAD) due to a fall involving a bed, n_{BB} is the number of cases admitted to the hospital for falls from bunk beds

[†] *International Classification of Diseases, 9th Revision.*

(CHIRPP), N_B is the number of cases admitted to the hospital for falls from all bed types (CHIRPP), and $\hat{N}_{age}$ is the population estimate for the given age group.[31]

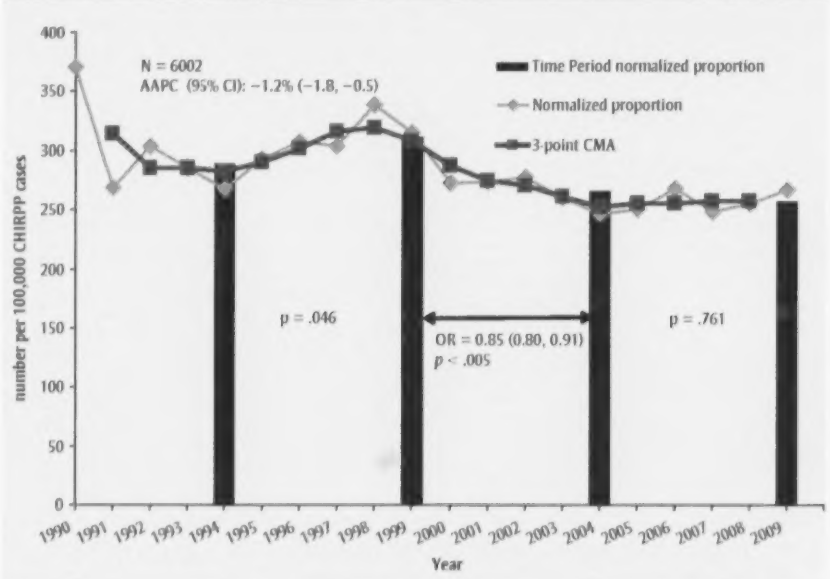
The rates were calculated over the 6-year period 2003/2004 to 2008/2009. The variability was characterized by calculating a 95% CI on F_{CHIRPP}. All analyses were performed using SAS version 9.2 (SAS Institute Inc., Cary, NC, United States) and Microsoft Excel 2007 (Redmond, WA, United States).

Results

Annual trend

Over the 20-year surveillance period, 6002 individuals presented to Canadian emergency departments for injuries associated with a bunk bed. While there were some period-to-period fluctuations in the proportions of cases, the frequency of bunk bed-related injuries in CHIRPP has overall remained relatively stable with an AAPC of −1.2% (−1.8, −0.5; Figure 1).

FIGURE 1
Annual trend of emergency department surveillance of injuries associated with bunk beds, CHIRPP, all ages, 1990–2009, Canada (N = 6002)



Abbreviations: AAPC, average annual percent change; CHIRPP, Canadian Hospitals Injury Reporting and Prevention Program; CI, confidence interval; CMA, central moving average; OR, odds ratio.

Note: Counts are expressed as a proportion of all cases in the given year (normalized counts). A 3-point CMA is applied to the normalized counts to smooth year-to-year fluctuations. The vertical bars are overall normalized counts ending on each 5-year period (1990–1994, 1995–1999, 2000–2004 and 2005–2009).

Overview

Table 1 summarizes the 5-year subset of analyzed cases. Figure 2 shows the normalized age- and sex-distribution by single year. Overall, 60.5% (n = 934) of

TABLE 1
Summary of emergency department surveillance of injuries associated with bunk beds, CHIRPP, all ages, 2002–2006, Canada

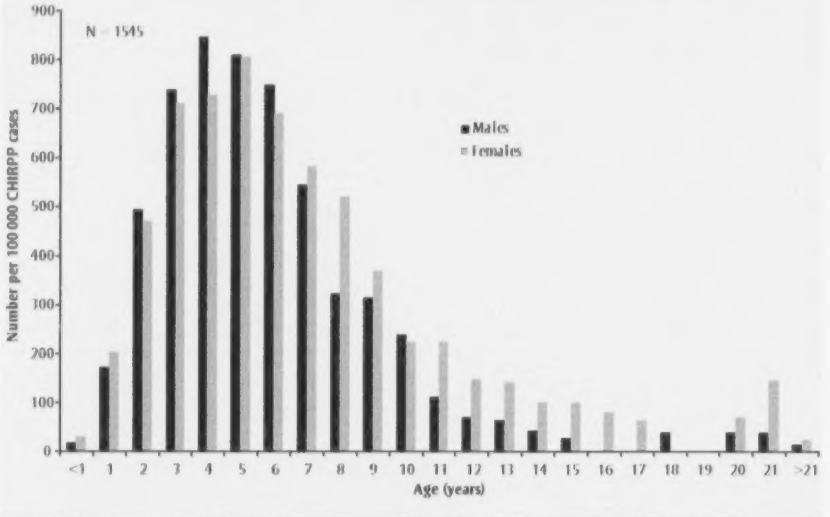
Bunk bed level	Number of cases, n (%)		Falls,[a] %
Upper	934	(60.5)	93.0
Ladder	263	(17.0)	96.6
Lower	53	(3.4)	67.9
Other[b]	28	(1.8)	35.7
Unknown	267	(17.3)	88.3
Total	**1,545**	**(100.0)**	**90.9**

Abbreviation: CHIRPP, Canadian Hospitals Injury Reporting and Prevention Program.

[a] Percentage of all cases for the given bunk bed level that were falls, including jumps.

[b] Patient was not on the bunk bed at the time of injury: contact with bunk bed, other person fell or jumped from the bunk bed and struck the patient who was sleeping on the floor, ladder fell on patient.

FIGURE 2
Emergency department surveillance of injuries associated with bunk beds according to age and sex, CHIRPP, all ages, 2002–2006, Canada (N = 1545)[a]



Abbreviation: CHIRPP, Canadian Hospitals Injury Reporting and Prevention Program.

[a] Counts normalized to the total number of cases in CHIRPP for the specific age-sex combination.

cases were related to the upper bunk, and of those, 93% were falls. When normalized for their total numbers in the database, girls were slightly more frequent for certain age groups.

The remainder of the analysis relates mostly to the 934 upper bunk-related cases. Other cases will be described briefly.

Upper bunk

Table 2 summarizes select characteristics of the upper bunk-related events. Incidents peaked in the 3- to 5-year age group (38.3%; 471.2/100 000) and 10.8% were admitted to hospital. Where reported, 42.7% (186/436) of the incidents occurred while the child was sleeping. Table 3 summarizes the specific mechanisms involved. Of the falls where the mechanism was known (n = 664), at least 45.9% (305/664) involved an activity which would be considered as appropriate use (sleeping/resting, getting in/out, sitting). Table 4 shows the distribution of all injuries suffered by the patients. Up to 3 injuries can be recorded on the CHIRPP form; Table 4 shows all injuries sustained, that is, that 934 children suffered 1044 injuries. Head, face and neck injuries accounted for 39.2% (409/1044) of all injuries, and brain injuries represented about 20%. Fractures made up about 40% of the total and about 1% were skull fractures.

Ladder and lower bunk

Almost one-fifth of all incidents involved the bunk-bed ladder. As a proportion of all same-age cases, 3- to 5-year-old children were most frequent at 147.4/100 000 CHIRPP cases. About one-third of the injuries were fractures and 5.3% were admitted to hospital. A smaller percentage occurred on the lower bunk. Children aged 10 to 13 years were most frequent at 15.9/100 000, and 3.8% were admitted to hospital.

TABLE 2
Emergency department surveillance of injuries associated with upper bunk-related incidents, CHIRPP, all ages, 2002–2006, Canada

Characteristic	Number of cases (n = 934)	
	n	%
Age group, years		
< 3	131	14.0
3–5	358	38.3
6–9	297	31.8
10–13	103	11.1
14–17	30	3.2
18 +	15	1.6
Sex		
Males	527	56.4
Time of day		
12:00 a.m. to 7:59 a.m.	127	13.6
8:00 a.m. to 11:59 a.m.	48	5.1
12:00 p.m. to 3:59 p.m.	69	7.4
4:00 p.m. to 7:59 p.m.	108	11.6
8:00 p.m. to 11:59 p.m.	127	13.6
Unknown	455	48.7
Disposition		
Left without being seen, advice only	202	21.6
Treated, medical follow-up if necessary	226	24.2
Treated, medical follow-up required	368	39.4
Prolonged observation in ED	37	4.0
Admitted to hospital	101	10.8
Direct Cause		
Floor	660	70.7
Bed (including ladder)	73	7.8
Other furniture	40	4.3
Toy	7	0.7
Ceiling fan[a]	5	0.5
Other	24	2.6
Unknown	125	13.4
Type of surface impacted (falls)[b]		
Non-carpeted[c]	343	39.5
Carpeted	109	12.5
Unknown	417	48.0
Usage		
Playing	250	26.8
Sleeping	186	19.9
Other/unknown	498	53.3

Abbreviations: CHIRPP, Canadian Hospitals Injury Reporting and Prevention Program; ED, emergency department.

[a] One other case related to a ceiling fan that resulted in a fall (direct cause was the floor).

[b] Based on falls from the upper bunk (n = 869).

[c] Includes hardwood, ceramic, cement and linoleum/vinyl floors.

Estimates of bunk bed-related hospitalizations due to falls

Table 5 shows the results of the methodology used to estimate bunk bed-related hospitalizations due to falls. Using the example of 5- to 9-year-olds in Table 5, the scaling factor (F_{CHIRPP}) is interpreted as follows: In CHIRPP, among those admitted to hospital for an injury involving a fall from any type of bed, 41.2% involved bunk beds. Overall, the estimated rates were relatively low, peaking among children aged 5 to 9 years.

TABLE 3
Emergency department surveillance of mechanism of upper bunk-related incidents, CHIRPP, all ages, 2002–2006, all ages, Canada

Mechanism	Number of cases (n = 934)	
	n	%
Falls	***869***	***93.0***
Unintentional fall	**803**	**85.9**
While playing	247	26.4
While sleeping or resting	186	19.9
While getting in or out	99	10.6
While reaching for an object or leaning over	21	2.2
While jumping/standing on bunk bed	21	2.2
While sitting on bunk bed	20	2.1
Due to guardrail collapse	3	0.3
Struck by ceiling fan	1	< 0.3
Not specified	205	21.9
Jumped off	**66**	**7.1**
Non-falls	***65***	***7.0***
Playing (not further specified)	18	1.9
Pushed or interfered with	17	1.8
Struck ceiling or top bunk while jumping on bunk bed	6	0.6
Struck by ceiling fan	5	0.5
Hanging/strangulation[a]	3	0.3
Body part entrapment	2	< 0.3
Other[b]	14	1.5
Total	**934**	**100.0**

Abbreviation: CHIRPP, Canadian Hospitals Injury Reporting and Prevention Program.

[a] The circumstances surrounding these cases are not clear – possibly attempted suicides, unintentional snagging or patient playing the "choking game" or some form of autoerotic asphyxia.

[b] Includes where patient jumped into bunk bed, struck against bunk bed, was jumped on by another person and incidents that do not clearly indicate the circumstance of injury.

Discussion

Our study provides the first comprehensive analysis of children presenting to Canadian emergency departments with bunk bed-related injuries. The narrative of the CHIRPP database was exploited to profile bunk bed-related injuries. The CHIRPP was also used as a tool to develop a scaling factor, or multiplier, that could be used to approximate the crude rates of injury hospitalizations due to falls from bunk beds and gain more insight into national hospitalization data related to these.

Annual trend

Although the CHIRPP data show a significant decline over 2000 to 2004, the trend stabilized over 2004 to 2009. Generally, one must be cautious when interpreting time trends; admissions policies, enhanced capture, changes in exposure and other factors may obscure subtle changes. However, sharp increases, decreases or persistence (slope ≈ 0) can be detected. Although there was an AAPC of −1.2%, this change is small and of little practical significance to injury prevention programs; it is equivalent to a reduction of approximately 4 cases per year.

Age guidelines

Health Canada's Consumer Product Safety Directorate and the U.S. Consumer Product Safety commission recommend that children aged less than 6 years not be allowed on the upper bunk.[5,13] Our results show that 52.3% of all injured patients were aged less than 6 years and that the peak age of falls and injuries is 3 to 5 years.

International literature

There have been a number of reports from other countries about bunk bed injuries.[4,8,14–18,32–33] Belechri et al.[4] compared the fall injury risk of bunk versus conventional beds in children under 15 years old who presented to the emergency departments of four hospitals in Greece over a three-year period (1996–98). Overall, 10.5% of falls were from bunk beds, with a peak age of 0 to 4 years (47.7%). Compared with conventional beds, bunk bed-related injuries were more serious, with a higher proportion of fractures, brain injuries and hospital admissions. Almost one-fifth (18.8%) of the falls occurred while the child was sleeping. D'Souza et al.[8] updated an earlier study by Mack et al.[15] who, using the National Electronic Injury Surveillance System (NEISS), examined bunk bed-related injuries among those aged under 21 years treated in U.S. emergency departments over a 16-year period (1990–2005). During this 16-year period, about 35 790 (42/100 000) cases of bunk bed-related injuries were treated annually, with the peak age at 3 to 5 years (33.2%) and no significant trend. Selbst et al.[14] prospectively studied injuries associated with bunk beds presenting to an emergency department for a one-year period (1987–1988). Of the 68 children who presented, 69% were aged under 6 years and almost one-third (29%) of the injuries occurred while the child was asleep. Mayr et al.[16] retrospectively described 218 bunk bed injuries from a pediatric trauma unit in Graz, Austria, for 1990–1999. The injuries were quite severe, including concussions (20.2%), fractures (27.5%) and 2 lacerated spleens (0.9%). Almost one-quarter (23.8%) of children were aged under 3 years. Macgregor[17] reported on 28 children who had fallen from an upper bunk; most (78%) were aged under 6 years, and 85% of falls occurred while the child was sleeping. Watson et al.[18] reported on bunk bed injuries in Australia, where about 2100 bunk bed-related injuries were treated annually in hospital emergency departments (50/100 000). The majority (86%) of these injuries occurred in

TABLE 4
Emergency department surveillance of injury profile (body part and nature of injury) of upper bunk-related incidents (n = 934), CHIRPP, all ages, 2002–2006, Canada

Injury[a]	Number of cases,	
	n	%
Upper extremity	***411***	***39.4***
Fracture	340	
Soft Tissue	36	
Sprain/strain	16	
Other minor upper extremity injuries	19	
Head, face, neck	***409***	***39.2***
Closed head injuries (brain)	**206**	**19.7**
Minor closed head injury	163	
Concussion	41	
Intracranial	2	
Scalp and facial lacerations	**86**	**8.2**
Fractures	**19**	**1.8**
Skull	10	
Facial	7	
Cervical	2	
Neck sprain/strain	**8**	**0.8**
Other minor scalp, face and neck injuries	**90**	**8.6**
Lower extremity	***148***	***14.2***
Fracture	58	
Soft tissue	43	
Superficial	19	
Sprain/strain	19	
Other minor lower extremity injuries	9	
Trunk	***54***	***5.4***
Bruise, abrasion	25	
Soft tissue	19	
Spinal fracture (thoracic)	2	
Injury to internal organ (abdomen)	1	
Other minor trunk injuries	7	
Asphyxia	***2***	***0.2***
Other/unknown	***20***	***1.9***
Total	**1044**	**100**

Abbreviation: CHIRPP, Canadian Hospitals Injury Reporting and Prevention Program.

[a] Up to three injuries can be reported per case, all injuries are indicated in this table (i.e. the 934 patients suffered 1044 injuries)

children aged under 10 years, peaking in the 5- to 9-year age group. Falls from the upper bunk resulting in a fracture accounted for 33% of injuries and concussions, 10%. Johnson[33] described a pediatric Lisfranc injury, commonly called a "bunk bed" fracture. The injury is considered major as there is ligamentous involvement and deformity. While only 14.2% of all injuries in our study were to the lower extremity, of those 53% of lower extremity fractures were to the foot. However, there was insufficient anatomical detail to classify the foot fractures as a Lisfranc injury.

The results of our investigation align with that of many international studies: [4,8,14–18,32–33] a high proportion of fractures and head injuries, more admissions compared to falls from conventional beds and peak age of injury under 6 years. In addition, a significant proportion of incidents occurred while the child was sleeping (19.9%; 186/934), which has implications for regulations and standards. Although insufficient information was available in the narratives, for a fall to have occurred from the upper bunk while the child was sleeping, the guardrails were either not attached or broke off during the fall or the child fell through the guardrail opening or through the portion of the bed frame that has no guardrail (the entrance).

Admissions to hospital are often used as a proxy for injury severity. The admission rates recorded in the above-referenced international studies [4,8,14–18] ranged from 2.9% to over 30% of all bunk bed-related injuries. It is difficult to compare admission rates between countries—or even within a country—due to different administrative policies and other factors. The most reliable comparison is between different injury mechanisms within the same surveillance system. In our study, cases involving the upper bunk had an admission rate of 10.8%, whereas those involving the ladder and the lower bunk had admission rates of 5.3% and 3.8%, respectively. Injuries associated with conventional beds, which are about 8 times as frequent as bunk-bed injuries in CHIRPP, have an admission rate of 3%. A comparison of injuries of lower bunk users and those of conventional beds users would be of interest; even though height would not be a factor, there may be a higher severity of injury for the lower bunk user due to the presence of the upper structure.

Short-distance free-falls

There is ample literature on free falls from a height.[34–47] Based on this literature, short falls are defined as less than 1.2 m to 1.5 m (4–5 feet) whereas significant fall height for the purposes of triage and injury severity is greater than 3.0 m to 4.6 m (10 to 15 feet). Bunk beds, at 1.7 m to 2.0 m (5.5–6.5 feet), are generally slightly higher than the cut-off for short distance falls. Nevertheless, there is a 50% difference in kinetic energy between a 1.2 m (4 feet) and a 2.0 m (6 feet) fall. The results of this study and others show that

TABLE 5
Estimates of the crude rate of hospitalizations (per 100 000 population) associated with falls from bunk beds, 0–14 years, fiscal years 2003/2004 to 2008/2009, Canada

Age group, years	F_{CHIRPP}[a], mean (SD)	Hospitalizations (all bed types)[b]		Bunk bed Falls	
		Count $_{ICD\ 10\ W06}$	Crude rate	Estimated rate ($\hat{R}_{BB}$)	95% CI[c]
0–4	0.117 (0.038)	1286	16.72	1.95	1.44–2.45
5–9	0.412 (0.088)	461	5.41	2.23	1.85–2.61
10–14	0.656 (0.216)	114	1.18	0.78	0.57–0.98
0–14	**0.242 (0.048)**	**1861**	**7.20**	**1.74**	**1.47–2.02**

Abbreviations: CHIRPP, Canadian Hospitals Injury Reporting and Prevention Program; CI, confidence interval; CIHI, Canadian Institute for Health Information; ICD-10 W06, *International Classification of Diseases, 10th Revision* code W06; SD, standard deviation.

[a] Scaling factor developed from case ratios (bunk bed injuries to all bed injuries, admitted for falls from a bed) in CHIRPP, fiscal years 2003/2004 to 2008/2009, ages 0–14 years.

[b] Source: Health Surveillance and Epidemiology Division (Centre for Chronic Disease Prevention) analysis of PHAC holdings of CIHI morbidity data. Bed types include cribs, toddler beds, conventional beds and bunk beds.

[c] Variability is calculated with respect to the scaling factor rather than the rate per se.

serious injuries are indeed possible from bunk-bed falls.

Other events

Although most of the non-fatal injuries are caused by falls, there are a number of rare and/or serious non-fall injury mechanisms associated with bunk beds, principally to do with intentional or unintentional strangulation. Our investigation found 3 (0.3%) cases of hanging/strangulation. However, it was not clear whether these were attempted suicides, unintentional snagging of clothing or possibly a result of playing a "choking game," the cause of death in one fatal case of a 12-year-old girl found hanging from her bunk bed.[48]

Another mechanism involves head injury from ceiling fan blades. We found 6 cases, one of which lead to a fall. Mack et al.[15] found that 8% of cases involved ceiling fans. Alias et al. [49] found jumping on a bunk bed to be a mechanism of such injuries.

Rate estimation and exposure

In this study, we used the CHIRPP database in a different way to help overcome the limitations of ICD coding and to form estimates of the rates of hospitalization due to falls from bunk beds. We found these to be fairly low: 1.74/100 000 (ages 0–14 years) with a peak at age 5 to 9 years (2.23/100 000). D'Souza et al.[8] reported a rate of 42/100 000 for all emergency department presentations (0–21 years) and Watson et al.[18] found this rate to be 50/100 000 for Australia and 22/100 000 for the Netherlands (0–14 years). Since hospital admission rates vary between countries, it is not possible to compare estimates. As a comparison, Canadian hospitalization data for falls from playground equipment[30] over the same time period demonstrate rates ranging from about 16/100 000 for those aged under 4 years to 55/100 000 for 5–9 year-olds.

Although these rates for bunk bed-related falls are population-based, they are not the true population rates since we do not know the number of children sleeping in bunk beds who do not get injured. A first step in calculating a true population rate would be to have a reliable measure of the number of Canadian households with bunk beds. We were unable to find any Canadian data, but there were a small number of surveys from other countries. Based on two Australian surveys, Watson et al.[18] found the prevalence of bunk beds to be 11% to 15%, while Senturia et al.[50] indicating that, based on a cross-sectional survey of 679 Chicago families, 24% used bunk beds.

Limitations

CHIRPP data do not represent all injuries in Canada. Older teenagers and adults, native people, people living in rural areas and those fatally injured are all under-represented.

Conclusions

Young children continue to present to Canadian emergency departments suffering from bunk bed-related injuries, including serious ones. Injury prevention programs would best be served by a two-pronged approach. First, the high proportion of children falling out of the upper bunk while they are sleeping indicates that further attention is needed in the areas of manufacturing and standards and regulation. The second arm of the mitigation approach relates to education with respect to appropriate/inappropriate use of the bunk (age, playing). CHIRPP surveillance will continue to help inform prevention/mitigation programs.

Acknowledgements

We thank the Consumer Product Safety Directorate, Health Canada, for suggestions related to regulation and standards as well as for providing the Canadian bunk bed fatality data.

Also, thank you to Sabrina Ramji, MHSc, University of Toronto, for her preliminary extraction and analysis of CHIRPP data (student project).

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Validation of ICD-9 diagnostic codes for bronchopulmonary dysplasia in Quebec's provincial health care databases

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This article has been peer reviewed.

Abstract

Introduction: Bronchopulmonary dysplasia (BPD) is a chronic respiratory disease caused by neonatal lung injury. The aim of this study was to validate the use of ICD-9 diagnostic codes for BPD in administrative databases to allow for their use in health care utilization analyses.

Methods: The validation process used a retrospective cohort composed of preterm infants, with or without respiratory complications, admitted to the Montréal Children's Hospital, Montréal, Quebec, between 1983 and 1992. BPD subjects were identified using ICD-9 diagnostic codes in the provincial administrative databases (medical services and MED-ECHO) and then matched with subjects with confirmed BPD from the validation cohort. We examined concordance and estimated sensitivity and specificity associated with the use of these diagnostic codes for BPD.

Results: True positive and false negative BPD subjects did not differ significantly according to gestational age, birth weight and Apgar scores. False positive BPD subjects were found to have significantly lower gestational age than true negative subjects. The use of the ICD-9 diagnostic codes for BPD was associated with a specificity between 97.6% and 98.0%. The sensitivity was lower at 45.0% and 52.4% for the medical services and MED-ECHO databases, respectively. Milder cases of BPD tended to be missed more frequently than more severe cases.

Conclusion: The specificity of the use of ICD-9 diagnostic codes for BPD in the Quebec provincial health care databases is adequate to allow its routine use. Its lower sensitivity for milder cases will likely result in an underestimation of the impacts of BPD on the long-term health care utilization of preterm infants.

Keywords: bronchopulmonary dysplasia, administrative databases, international classification of diseases

Introduction

Bronchopulmonary dysplasia (BPD) is a chronic respiratory disease that develops as a result of neonatal lung injury. It is one of the most important sequelae of preterm birth,[1] and is most common in preterm infants who need mechanical ventilation and oxygen therapy for respiratory distress syndrome (RDS) of the newborn.[2]

BPD was first described four decades ago in children born slightly preterm with severe RDS who were then exposed to aggressive mechanical ventilation and high concentrations of inspired oxygen.[3] It has since been largely replaced by a new form of the condition occurring in more extreme preterm infants, often with less severe RDS as a result of administering pulmonary surfactant.[4]

Despite notable advances in prenatal and neonatal care, BPD remains a major complication, frequently resulting in mortality as well as short-term and long-term morbidities. With the high rate of preterm births worldwide[5] and the improved survival associated with preterm birth, numerous young adults who were born prematurely and suffered respiratory complications at birth manifest chronic obstructive pulmonary disease in late adolescence and/or early adulthood.[6]

Health administrative databases

In the Canadian province of Quebec, the costs of medical services and hospital care for all residents are covered by a universal health insurance program administered by the Régie de l'Assurance-Maladie du Québec (RAMQ). RAMQ holds a vast quantity of information useful for facilitating clinical and epidemiological research work and for assisting health professionals in decision making.

Since 1983, RAMQ has recorded the date of each delivered medical service claim and the relevant ICD-9 (*International Classification of Diseases, 9th revision*)[7] codes for clinical diagnoses. The medical service claims database includes all physician reimbursement claims for hospital and ambulatory medical services provided to Quebec residents.

Despite the potential advantages of administrative databases, the validity of the data, particularly the clinical diagnoses, may be uncertain. Studies have shown that clinical diagnoses were not reliable for common diseases such as asthma

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and chronic obstructive pulmonary disease.[8,9] As a result, despite that records such as these could prove extremely valuable in examining the history, prognosis and treatment of a condition, the ability of these databases to accurately identify patients with such conditions must be determined. The aim of this study was to validate the use of the Quebec provincial health administrative databases to identify patients who developed BPD as a complication of preterm birth and to observe potential differences in their health care utilization based on the presence or absence of BPD.

Methods

Study design and selection of subjects

Validation cohort

The retrospective validation cohort included all preterm infants, that is, gestational age of less than 37 weeks (259 days),[10] with or without respiratory complications, who were admitted to the Montréal Children's Hospital (Montréal, Que.) between 1 January 1983 and 31 December 1992. The Montréal Children's Hospital is a tertiary pediatric hospital with specialized neonatal care that serves as a referral centre for the province of Quebec. It does not have a maternity unit, and all study subjects were transferred or admitted to the hospital following a premature birth. Data were abstracted from hospital records using a standardized data collection sheet. The subjects were identified using the ICD-9 codes listed on their medical discharge summary (prematurity: 765.*; BPD: 770.7; RDS: 769.*). Information collected included demographic characteristics as well as maternal, prenatal, delivery and main neonatal outcomes. Subjects' charts were carefully reviewed for evidence of BPD, as defined by the need for supplemental oxygen for at least 28 days[11] (see Table 1). Disease severity was assessed at 36 weeks postmenstrual age (or 56 days of life if born after 32 weeks) as mild BPD if breathing room air (fraction of inspired oxygen [FiO_2] = 0.21); moderate BPD (FiO_2 < 0.30); and severe BPD (FiO_2 > 0.30 or else positive pressure ventilation). Infants with BPD who died of respiratory causes before the assessment date were considered to have severe disease.[11] The validation cohort included only those subjects for whom gestational age and neonatal exposure to supplemental oxygen (timing, duration, FiO_2) were known.

Provincial databases cohort

We constructed a retrospective cohort of all subjects born in Quebec between 1983 and 1992 with respiratory complications of preterm birth using data from two RAMQ-administered provincial databases, the MED-ECHO database and the Medical services database. The MED-ECHO database[7] contains information on acute care hospitalizations and day surgeries performed in Quebec. Each record contains identifying demographic information along with the primary diagnosis on admission and 15 possible secondary diagnoses. This database was initiated 1 April 1987 and is complete for all subjects born thereafter.[12] The Medical services database includes data on diagnosis, medical billing (type of service performed, specialty of claimant, setting of the service (outpatient clinic, private clinic, emergency department, in-patient clinic) as well as the number of claims, the date on which the service was performed and the cost paid by RAMQ to the billing physician. This database is complete from 1 January 1983.

These two databases were used to identify all subjects with a preterm birth, defined as a gestational age of less than 37 weeks (using ICD-9 code 765.*and ICD-10 code P07.*) and diagnosed with associated respiratory complications, either BPD (ICD-9 code 770.7, ICD-10 code P27.1) or RDS (ICD-9 code 769.*, ICD-10 code P22.*).[7] Data were extracted from 1 January 1983 (or 1 April 1987 in the case of the MED-ECHO database) until 31 March 2008. ICD-9 codes were used in these databases from 1 April 1981 until 31 March 2006, and ICD-10 codes from 1 April 2006.[7]

Matching process

The validation cohort was matched with each of the provincial administrative databases using the subjects' unique

TABLE 1
Definition of bronchopulmonary dysplasia: diagnostic and severity criteria

	Diagnosis of BPD	
Gestational age, weeks	< 32	≥ 32
Time of assessment	36 weeks PMA or discharge home, whichever comes first	> 28 days but < 56 days postnatal age or discharge home, whichever comes first
	Treatment with oxygen	
Mild BPD	Breathing room air (FiO_2 = 0.21) at 36 weeks PMA or discharge, whichever comes first	Breathing room air by 56 days postnatal age or discharge, whichever comes first
Moderate BPD	Need for FiO_2 < 0.30 at 36 weeks PMA or discharge, whichever comes first	Need for FiO_2 < 0.30 at 56 days postnatal age or discharge, whichever comes first
Severe BPD	Need for FiO_2 > 0.30 and/or positive pressure (PPV or NCPAP) at 36 weeks PMA or discharge, whichever comes first	Need for FiO_2 > 0.30 and/or positive pressure (PPV or NCPAP) at 56 days postnatal age or discharge or discharge, whichever comes first

Source: Jobe & Bancalari, 2001[11]

Abbreviations: BPD, bronchopulmonary dysplasia; NCPAP, nasal continuous positive airway pressure; PMA, postmenstrual age; PPV, positive pressure ventilation; FiO_2, fraction of inspired oxygen.

RAMQ identification number. No nominal data were used. Access to the RAMQ database was approved by the Commission d'accès à l'information du Québec. This study was approved by the research ethics board of the McGill University Health Centre.

Statistical analyses

Subjects were divided into four categories: (1) true positive BPD subjects who had been diagnosed with BPD during their initial admission following preterm birth and were labelled as having BPD in the administrative databases; (2) false positive BPD subjects who did not have BPD during their initial admission or subsequent re-admissions but had been labelled as such in the administrative databases; (3) false negative BPD subjects who were in the reverse situation, having been diagnosed with BPD but not labelled as such in the databases; and (4) true negative subjects who had neither respiratory complications nor RDS following a preterm birth and were not labelled as having BPD in the administrative databases. We examined the overall characteristics associated with correctly classified and misclassified cases of BPD and used a subject-years approach to analyze health care utilization. Analysis of variance (ANOVA) or *t*-tests were used to compare means of continuous variables, and Mantel–Haenszel chi-square tests to compare ordinal variables. Concordances were examined, resulting in overall and yearly estimates of sensitivity and specificity associated with the use of diagnostic codes for BPD in each of the administrative databases. For multivariable analysis, variables that were significantly associated with the outcome in univariate analyses were initially included, and a multivariate Poisson regression model[12] was used to determine the association of clinical factors with the number of admissions and outpatient and emergency department visits. Significance was set at $p \leq .05$. Statistical analyses were conducted using statistical package SAS version 9.2 (SAS Institute Inc., Cary, NC, United States).

Results

Subjects' characteristics

The validation cohort consisted of 894 preterm subjects admitted to the Montréal Children's Hospital between 1983 and 1992. From the RAMQ records, 3442 preterm subjects were identified (773 with BPD and 2669 with RDS). Of these, 876 were successfully matched with the validation cohort.

Table 2 shows the characteristics of the matched subjects. Gestational age differed significantly between the true negative and false positive groups, with false positive BPD subjects being on average more premature than the subjects correctly classified as not suffering from BPD (31 and 34 weeks of gestation, respectively).

The use of the diagnostic codes for BPD was associated with a specificity of 97.6% for the medical services database and 98.0% for the MED-ECHO database.

TABLE 2
Characteristics of the correctly classified and misclassified preterm bronchopulmonary dysplasia subjects in the RAMQ databases, 1983–1992, Quebec, Canada

	RAMQ classification category					
	True positive[a]	False negative[b]	*p*	True negative[c]	False positive[d]	*p*
Preterm subjects, n	104	137	—	623	12	—
Male, n (%)	59 (56.7)	84 (61.3)	.47	384 (61.6)	8 (66.7)	.72
Birth weight, mean (SD) kg	1.15 (0.6)	1.05 (0.3)	.12	2.17 (0.7)	1.79 (0.7)	.12
Gestational age, mean (SD) weeks	28.0 (3.3)	27.7 (3.1)	.45	34.0 (2.9)	31.2 (3.8)	.004
1-minute Apgar score, mean (SD)	3.7 (2.4)	4.2 (2.4)	.13	6.5 (2.4)	6.1 (2.1)	.81
5-minute Apgar score, mean (SD)	6.2 (2.2)	6.4 (2.1)	.40	8.2 (1.9)	7.8 (1.3)	.78
BPD severity, (n, %)						
None	0	0	—	623 (100)	12 (100)	—
Mild	16 (15.4)	36 (26.5)	—	0	0	—
Moderate	52 (50.0)	52 (38.2)	—	0	0	—
Severe	36 (34.6)	48 (35.3)	—	0	0	—
Mortality						
Number, n (%)	5 (4.8)	0	—	0	1 (8.3)	—
Age, mean (SD) years	0.9 (0.64)	—	—	—	17.9 (—)	—

Abbreviations: BPD, bronchopulmonary dysplasia; RAMQ, Régie de l'Assurance-Maladie du Québec.

[a] True positive subjects were diagnosed with BPD following a preterm birth and labelled as diagnosed with BPD in the administrative databases.

[b] False negative subjects were not diagnosed with BPD but were labelled as such in the administrative databases.

[c] True negative subjects were neither diagnosed with BPD nor labelled as such in the administrative databases.

[d] False positive subjects were not diagnosed with BPD during their initial admission or subsequent re-admissions but were labelled as having BPD in the administrative databases.

Sensitivity was somewhat lower, a value of 45.0% and 52.4% respectively. Milder cases of BPD tended to be missed more frequently when comparing the proportion of false negative and true positive cases (Table 2). The misclassification of BPD subjects also varied over the years, with the sensitivity improving after the introduction of MED-ECHO in 1987 (see Figure 1).

Implications on health care utilization analyses

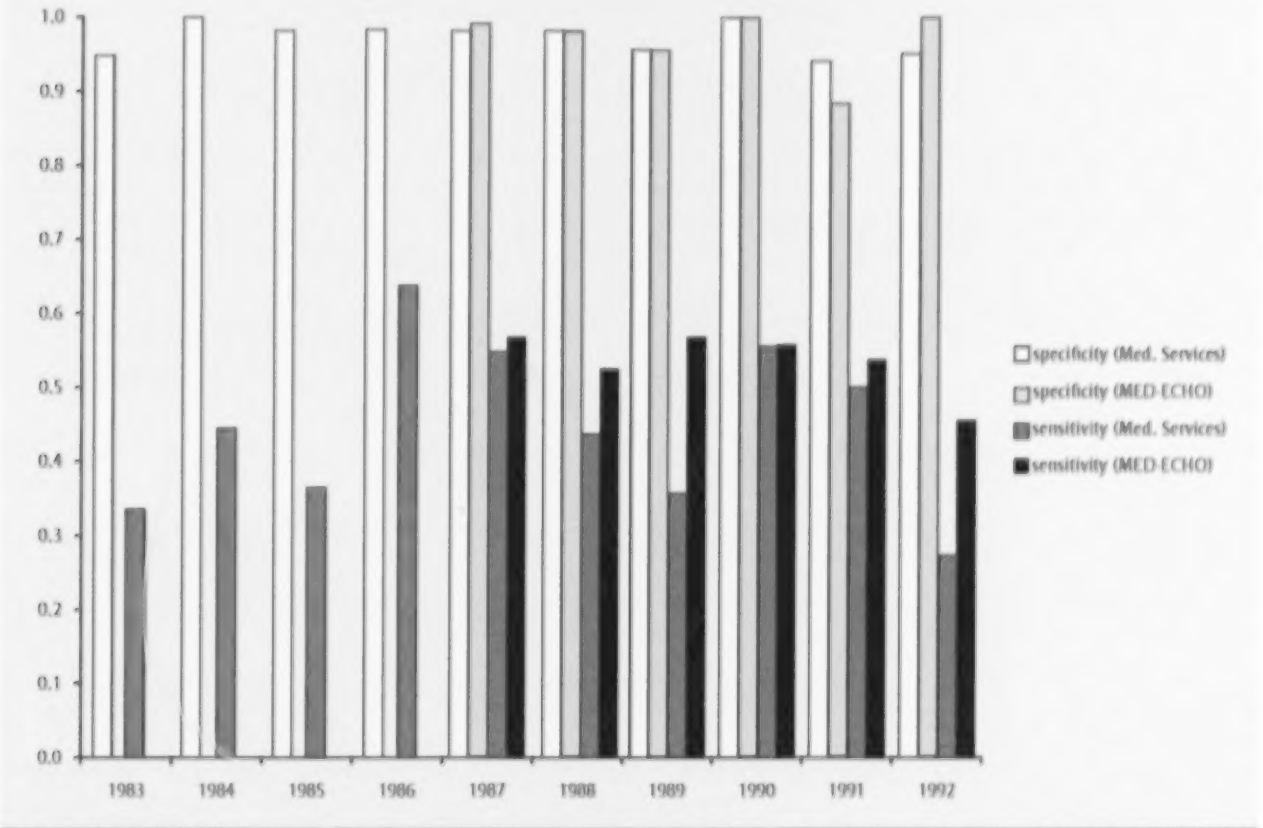
Table 3 shows the hospital readmissions rate per person-year across the four categories for the entire duration of the follow-up (mean follow-up duration: 19 years) as well as outpatient and emergency department visits. A diagnosis of BPD in the validation cohort was associated with adjusted rate ratios of 9.3 (95% confidence interval [CI]: 6.9–12.5) for hospital readmissions, 8.1 (95% CI: 7.6–8.6) for outpatient visits and 4.4 (95% CI: 3.6–5.3) for emergency department visits when adjusted for gestational age, birth weight, 1-minute Apgar score, maternal age and the initial severity of BPD according to the National Institutes of Health (NIH)-consensus definition.[11]

Discussion

The specificity for using ICD-9 diagnostic codes for BPD in the Quebec provincial health care databases was excellent, the sensitivity less so, especially before the introduction of the MED-ECHO database in 1987. The tendency was to miss milder cases of BPD. Since 2006, ICD-10 diagnostic codes have replaced ICD-9 codes in Quebec's administrative databases, but the relevance of documenting the predictive values associated with the ICD-9 code for BPD remains, particularly when looking at long-term health care utilization of preterm subjects older than 6 years of age.

Subjects classified as true negative had the fewest hospital readmissions and a shorter length of stay, whereas true positive BPD cases were associated with more outpatient and emergency department visits for the duration of the 19-year follow-up. False positive BPD subjects, who had been more premature at birth than those of their counterparts not diagnosed with BPD, had more hospital readmissions and a longer length of stay in hospital. The presence of BPD as a complication of a preterm birth was found to have a great impact on health care utilization, an effect that remained significant

FIGURE 1
Specificity and sensitivity of the medical services and MED-ECHO databases for the diagnostic codes of bronchopulmonary dysplasia, 1983–1992, Quebec, Canada



Abbreviation: Med, Medical.

TABLE 3
Health care utilization across correctly classified and misclassified preterm bronchopulmonary dysplasia subjects[a]

	RAMQ classification category					
	True positive[b]	False negative[c]	p	True negative[d]	False positive[e]	p
Hospital admissions[f]/person-year, n	1.6	1.3	.023	1.1	1.7	.004
Length of stay, mean (SD) days	11.6 (26.4)	18.3 (32.6)	.22	4.2 (7.8)	6.4 (15.8)	.01
Outpatient visits/person-year, n	6.7	3.2	<.0001	3.7	5.4	.45
ED visits/person-year, n	3.0	1.7	.0001	2.8	2.7	.33

Abbreviations: BPD, bronchopulmonary dysplasia; ED, emergency department; RAMQ, Régie de l'Assurance Maladie du Québec.

[a] Mean follow-up duration of BPD subjects was 19 years.

[b] True positive subjects were diagnosed with BPD following a preterm birth and labelled as having BPD in the administrative databases.

[c] False negative subjects were not diagnosed with BPD but were labelled as such in the administrative databases.

[d] True negative subjects were neither diagnosed with BPD nor labelled as such in the administrative databases.

[e] False positive subjects were not diagnosed with BPD during their initial admission or subsequent re-admissions but were labelled as having BPD in the administrative databases.

[f] Hospital re-admission following initial hospital discharge after birth.

when corrected for birth weight, gestational age, Apgar score and maternal age.

Limitations

The main limitation of this study is the evolving definition of BPD in clinical practice over the duration of the study period. Until the consensus definition for BPD was reached in 2000,[11] there was a striking lack of uniformity in the diagnostic criteria for BPD among clinicians and in the medical literature.[13] The criteria proposed to define BPD (suggested in an NIH-sponsored workshop in 1979) included continued oxygen dependency during the first 28 days in addition to compatible clinical and radiological changes.[4] These criteria were considered appropriate for the classic presentation of BPD, but less so for identifying "new" BPD cases identified after the early 1990s. Accordingly, the following definition was proposed: the need for supplemental oxygen at 36 weeks post-menstrual age (PMA).[14] This stricter definition was considered better for identifying infants with more severe lung disease and therefore at predicting long-term outcome.[15] This definition was further refined at an NIH workshop in 2000 to include the need for 28 days or more of supplemental oxygen as well as a severity assessment date at 36 weeks PMA.[11] A repeat validation study using subjects born after 2000 will address this limitation.

A minor limitation was the incomplete matching process (2%) between the validation cohort and the provincial databases cohort. Missing unique RAMQ identification numbers at the time of admission, a frequent occurrence in infants since they are admitted at birth under their maternal RAMQ identification number, accounted for the discrepancy of the matching process between the two cohorts.

A third limitation was the incompleteness of the MED-ECHO database over the first 4 years of the study period, likely resulting in an incomplete capture of the BPD cases during this time and an underestimation of the health care utilization with regard to the number of hospitalizations.

Conclusion

The specificity of the use of ICD-9 diagnostic codes for BPD in the Quebec provincial health care databases is adequate to allow its routine use. Its lower sensitivity for milder cases will likely result in an underestimation of the impacts of BPD on the long-term health care utilization of those born preterm.

Acknowledgements

This study was supported by a grant from the Réseau en Santé Respiratoire - Fonds de la recherche en santé du Québec.

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Report summary

Diabetes in Canada: facts and figures from a public health perspective

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Introduction

Diabetes in Canada: facts and figures from a public health perspective is the first comprehensive diabetes surveillance report published by the Public Health Agency of Canada. The report aims to support public health professionals and organizations in developing effective, evidence-based public health policies and programs to prevent and manage diabetes and its complications.

The report, developed in collaboration with provincial and territorial governments, the Canadian Diabetes Association, Juvenile Diabetes Research Foundation, CNIB, Health Canada and the academic community, uses data from national health surveys and vital statistics, as well as population-based administrative data from the Canadian Chronic Disease Surveillance System (CCDSS). For the first time, the CCDSS contains data from all 13 Canadian jurisdictions.

Using CCDSS data representing cases of diagnosed diabetes among Canadians aged one year and older, *Diabetes in Canada* presents prevalence and incidence national rates from the fiscal year 2008/2009 and national trends from 1998/1999 onwards.* The report also outlines sub-populations at higher risk, ways of reducing the risks of developing the disease and its complications, and estimates of related economic costs. In addition, it contains sections on specific populations, including children and youth and First Nations, Inuit and Métis populations.

Highlights

Prevalence and incidence

Nearly 2.4 million Canadians (6.8%) were living with diagnosed diabetes in 2008/2009. According to data obtained from blood samples, it is estimated that an additional 450 000 had undiagnosed diabetes at that time.

The overall age-standardized prevalence of diagnosed diabetes increased by 70% since 1998/1999. Prevalence has been consistently higher among males than females, and has increased in every age group, particularly in the 35- to 39-year and 40- to 44-year age groups, where proportions doubled. According to projections, an estimated 3.7 million Canadians will have diabetes by 2018/2019.

Over 200 000 Canadians (6.3 incident cases per 1000 population) were newly diagnosed with diabetes in 2008/2009 alone (6.8 incident cases per 1000 males, 5.7 incident cases per 1000 females), and nearly half were aged between 45 and 64 years. Age-standardized diabetes incidence rates among Canadians remained relatively stable between 1998/1999 and 2008/2009.

Diabetes in children and youth

In 2008/2009, more than 3000 incident cases of both types of diabetes were reported among Canadians aged 1 to 19 years. Type 1 diabetes remains the most prevalent form of diabetes in children and youth, but type 2 diabetes has been on the rise among youth worldwide for the last two decades.

Diabetes in First Nations, Inuit and Métis populations

The age-standardized prevalence of diabetes was 17.2% among First Nations people living on-reserve, 10.3% among those living off-reserve and 7.3% among Métis, while the prevalence among Inuit was comparable to that of the general Canadian population. Compared to non-Aboriginal individuals, Aboriginal people are generally diagnosed with diabetes at a younger age and experience higher rates of complications, and females experience higher rates of gestational diabetes.

Comorbidities, complications, health care utilization and economic burden

In 2009–2010, 36.5% of Canadian adults with diabetes reported having two or more serious chronic conditions (hypertension, heart disease, chronic obstructive pulmonary disease, mood disorder and/or arthritis). Compared to individuals without diabetes, those with the disease were

* Specific conventions are used to distinguish between different periods of reference used by the various data sources. The following section of the report presents more information on these conventions, periods of reference, and data sources: http://www.phac-aspc.gc.ca/cd-mc/publications/diabetes-diabete/facts-figures-faits-chiffres-2011/introduction-eng.php#bm1

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over 3 times as likely to be hospitalized with cardiovascular disease, 12 times as likely with end-stage renal disease and almost 20 times as likely with non-traumatic lower limb amputation.

In 2008/2009, working age adults (20–49 years old) with diabetes saw a family physician twice as often as those without diabetes, and specialists two to three times as often. Annual per capita health care costs have been estimated to be three to four times greater in a population with diabetes than that without.

Mortality

Diabetes itself does not typically cause death, but complications from diabetes can and do. This is reflected in decreased life expectancy and health-adjusted life expectancy. More than a quarter (29.9%) of those who died in 2008/2009 had diabetes. In every age group, individuals with diabetes have mortality rates at least double that of those without the disease.

Prevention

Social, economic, environmental, lifestyle and genetic factors all have significant effects on the distribution of type 2 diabetes in the Canadian population. Advancing age, obesity, physical inactivity and ethnic background as well as a family history of diabetes (or gestational diabetes) are all important risk factors.

Obese adults are two to four times as likely to have type 2 diabetes. In 2007–2009, 23.9% of adults aged 18 years and older were obese according to measured body mass index. In 2009–2010, almost half (47.4%) of Canadians aged 12 years and older reported that they were physically inactive (leisure and transportation index); in the same period, more than half (55.9%) reported eating vegetables and fruit less than five times a day, which is used as a proxy measure of unhealthy diet.

The risk factors for type 1 diabetes are still not well understood. Studies suggest that genetic predisposition and environmental factors that trigger the auto-immune response are implicated.

Summary

Although overall incidence of diabetes has been stable over the last decade, prevalence has been increasing steadily, resulting in a substantial number of Canadians living with diabetes. Our population is aging; together with increasing rates of obesity, the risk of developing diabetes is expected to increase. However, Canadians can reduce their individual risk by being physically active and by maintaining normal weight or losing excess body weight.

For those with diabetes, self-management through lifestyle modifications and/or use of blood sugar-lowering medication is key. Moreover, blood sugar, blood cholesterol, blood pressure, kidney function and the eyes should be regularly monitored to prevent or mitigate the development of complications.

The full version of this report is available on the Public Health Agency of Canada website at: http://www.phac-aspc.gc.ca/cd-mc/publications/diabetes-diabete/facts-figures-faits-chiffres-2011/index-eng.php

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